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ABSTRACT

The longitudinal analysis population of the National Education Longitudinal Study of 1988 (NELS:88) is used to produce descriptive findings about the transition to high school of eighth grade students. An overview summarizes some of the policy issues of the study and sketches the research design and samples. First, longitudinal data are used to describe some basic transitions, specifically, the proportions of the sample who changed between public and private sectors between the 8th and 10th grades or who dropped out of school. Eighth graders' perceptions of the ease of transition are summarized. Second, taking mathematics as an example, cross-sectional data are used to describe 10th grade learning and achievement, student reports of course-taking and classroom practices and emphases are summarized, and both sociodemographic and instructional correlates of mathematics achievement are examined. These examples illustrate the use of the two principal analysis populations available through the first follow-up dataset, a representative sample of 8th graders followed 2 years later as 10th graders. Eleven tables and five figures present analysis data. Further information about the availability and release schedules for NELS:88 data files is provided in four appendixes. (Author/SLD)

Transitions to High School; Instruction and Achievement: Findings From the NELS:88 First Follow-Up (1990) Student Survey

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Transitions to High School: Instruction and Achievement:
Findings From the NELS:88 First Follow-Up (1990) Student Survey

Leslie A. Scott, Steven J. Ingels

Abstract. This paper begins with an overview of NELS:88. The overview summarizes some of the policy issues treated by the study, and sketches the research design and the samples and analysis populations contained in the data set. The paper then offers descriptive findings in two areas that exemplify potential uses of NELS:88 first follow-up data. First, longitudinal data are used to describe some basic **transitions**, specifically, the proportions of the sample who changed between public and private school sectors between eighth and tenth grade or who dropped out of school. Also, eighth graders' perceptions of the the ease or difficulty of adapting to the high school environment are summarized. Second, taking mathematics as an example, cross-sectional data are used to describe tenth grade **learning and achievement**. Student reports of course-taking and of classroom practices and emphases are summarized, and both sociodemographic and instructional correlates of mathematics achievement are examined. The paper thus illustrates use of the two principal analysis populations made available through the first follow-up dataset--a representative sample of eighth graders studied two years later regardless of whether they are still enrolled in school and regardless of their grade level; and the NELS:88 sophomore cohort, a nationally representative sample of tenth graders in the spring term of 1990, fully comparable to the High School and Beyond sophomore cohort of a decade earlier. Further information about the availability and release schedules for NELS:88 data files and publications is provided in the appendices.

INTRODUCTION

With the completion of the first follow-up to the National Education Longitudinal Study of 1988 (NELS:88), and thus the collection of a second wave of data on the study's eighth grade longitudinal cohort, many of the policy concerns raised nearly a decade ago following the National Commission on Excellence in Education's report *A Nation at Risk* may profitably be explored, and the effects of improvement initiatives implemented to address these concerns traced and measured. Indeed, the year 1993 will mark one decade since this sobering report focused the nation's attention on the deteriorating condition of American secondary schools and sparked the present movement for reform. In addition to igniting the reform movement, the report also helped precipitate a national education agenda which called for a systematic program of research to provide ongoing information on the nature of the nation's secondary school system, students' experiences within the system and, for the first time, the role of students' early educational experiences on later secondary school achievements. It was in response to the need for such information that the National Center for Education Statistics (NCES) designed and launched NELS:88.

With the new national education agenda serving as a framework, NELS:88 was undertaken to address a number of policy issues the most important being the patterns of transition from eighth grade in elementary, junior or middle school to tenth grade in secondary school, and from twelfth grade to the workplace or postsecondary school; the dynamics of tracking and ability grouping, and implications of tracking for equity and educational outcomes; the determinants of persistence in school and dropping out of school; cognitive growth (and its correlates) over time; and the relationship (and tensions) between the renewed emphasis on excellence (as exemplified by rigorous standards of academic content and assessment), school and curricular choice, and longstanding concerns with equality of opportunity, seen in terms of effective access for all to various types of educational programs and institutions.

The completion of the base year survey in 1988 and the publication of the first report on the findings of the eighth grade cohort[1] provided a preliminary descriptive glimpse at some of these issues. With the completion of the first follow-up survey, longitudinal analyses may be performed and issues pertaining to the process of change and stability over time investigated. A few simple illustrations are presented here of uses of the first follow-up student data. First, basic descriptive findings are presented on patterns of school transition for the eighth grade longitudinal cohort, such as dropping out or persistence in school, student movement between public and private schools; and students' perception of the academic and social implications of their transition to high school. Second, findings are presented on the association between sociodemographic characteristics, curricular exposure, instructional style and students' tenth grade mathematics achievement.

To provide a context for reporting these findings, this paper begins with an overview of NELS:88 and description of the first follow-up research design, samples and corresponding populations. Thus this paper serves two objectives: first, to familiarize researchers, educators and policy analysts with the study design and analysis populations, and second, to present findings that illustrate both the longitudinal and cross-sectional use of the first follow-up student (1990) survey.

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[1] Hafner, A., Ingels, S., Schneider, B., and Stevenson, D. (1990). A Profile of the American Eighth Grader. Washington, D. C., National Center for Education Statistics. (NCES 90-458).

Part 1. Overview of NELS:88 and First Follow-Up Survey

1.1 Overview of NELS:88

Study Components. To accomplish its research objectives, NELS:88 studies, at two year intervals, an eighth grade cohort's progression through the secondary school system and on to postsecondary endeavors. The longitudinal data gathered from students is augmented through parent, teacher, school administrator and archival[2] accounts of students' progression and development. The simultaneous gathering of student and contextual data will lead to a better understanding of various facets of students' lives--their problems and concerns; their relationships with parents, peers, teachers; and the characteristics of their schools--and permit investigation of the effect of these factors on social, behavioral, and educational development. The basic study components, by round, are sketched below:

BASE YEAR	FIRST FOLLOW-UP	SECOND FOLLOW-UP	THIRD FOLLOW-UP
spring term 1988	spring term 1990	spring term 1992	spring 1994
GRADE 8	MODAL GRADE = SOPHOMORE	MODAL GRADE = SENIOR	H.S. + 2 YEARS
Students: Questionnaire, Tests*	**Dropouts, Students:** Questionnaire, Tests	**Dropouts, Students:** Questionnaire, Tests, H.S. Transcripts	**All Individuals:** Questionnaire
Parents: Questionnaire		**Parents:** Questionnaire	
Principals: Questionnaire	**Principals:** Questionnaire	**Principals:** Questionnaire	
Two Teachers per student: (taken from English, social studies, mathematics, science)	**Two Teachers per student:** (taken from English, social studies, mathematics or science)	**One Teacher per student:** (taken from mathematics or science)	

*Reading, social studies, math and science tests are administered in the three in-school rounds.

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[2] The primary records source to be sought is academic transcripts, which are recognized to be an objective and reliable measure of students' educational experience, far superior in level of detail, accuracy and completeness to student self-reports of course-taking and grades. As in High School and Beyond (HS&B), transcripts will be collected for students' entire high school careers. NELS:88 transcripts data will be released in 1993.

Intercohort Comparisons: NELS:88, HS&B, NLS-72. While the primary objective of NELS:88 is to support longitudinal analyses, the study is also designed to support the generation of single estimates in time and intercohort comparisons. For purposes of cross-sectional analyses, nationally representative samples of 1990 sophomores and 1992 seniors are made possible by means of a procedure for sample freshening. In both the first and second follow-ups, tenth and twelfth grade students, respectively, who did not have an opportunity for selection into the study in the base year were added to ensure nationally representative cross-sectional cohorts. With the creation of a nationally representative tenth grade cross-sectional cohort, trend comparisons between High School and Beyond (HS&B) 1980 sophomores and 1990 NELS:88 first follow-up sophomores may be drawn. Similarly, cross-cohort comparisons between the NELS:88 senior class of 1992, HS&B seniors of 1980 and 1982 and the National Longitudinal Study of the High School Class of 1972 (NLS-72) senior cohort may be conducted after the completion of the second follow-up. Figure 1 illustrates the sequential design of NELS:88 and its relationship to other NCES longitudinal studies.

1.2 First Follow-Up Research Design; Data Collection and Results; Populations

1.2.1 First Follow-up Research Design; Data Collection and Results

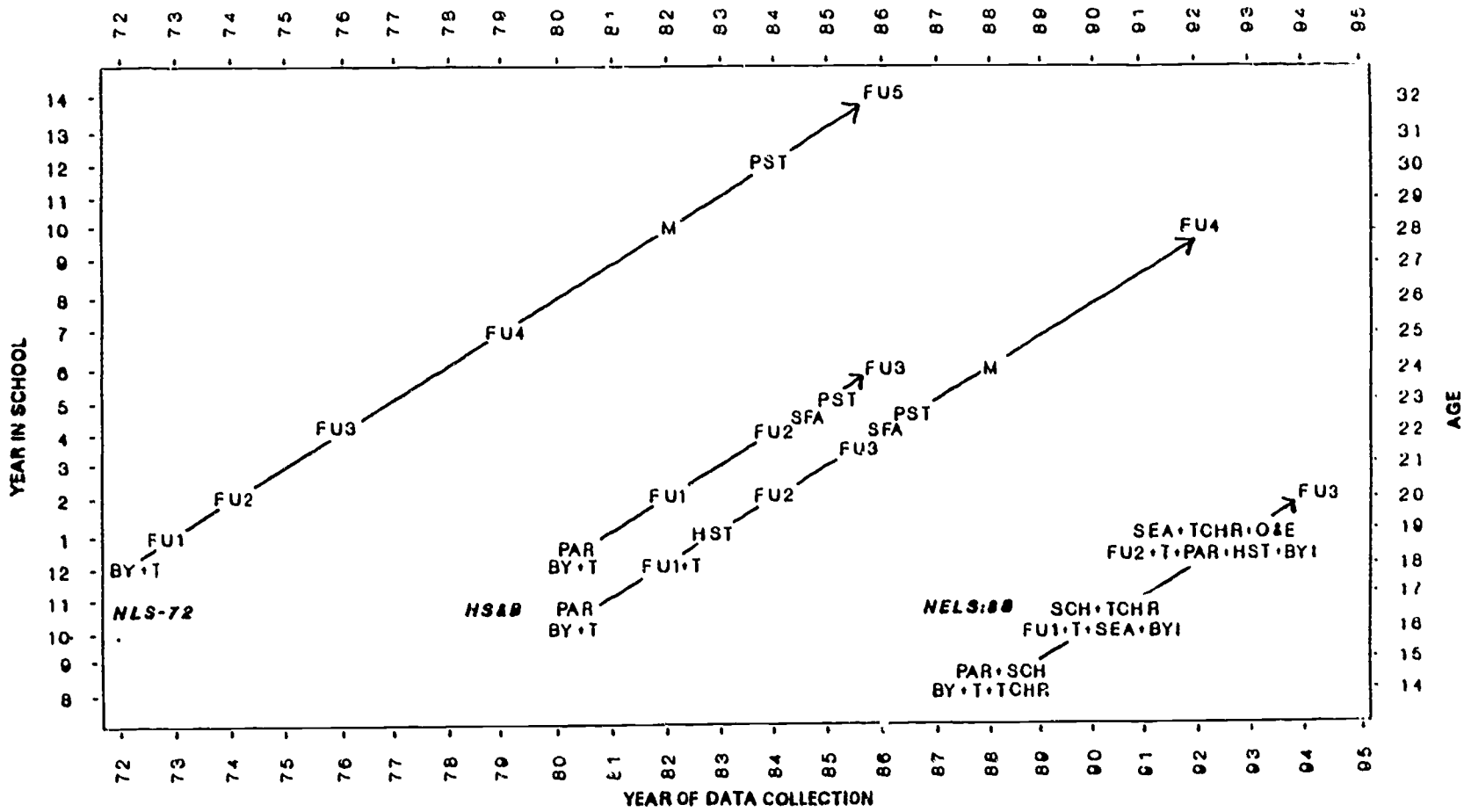
Three study components were carried over from the base year of NELS:88, and constitute the main first follow-up design: surveys and tests of students, and surveys of school administrators and teachers. In addition, three new components--the dropout survey, Base Year Ineligible Study, and School Effects Augmentation--where initiated in the first follow-up, and a freshened student sample was added to the student component.

As in the base year, students were asked to complete a questionnaire and cognitive test. The cognitive test was designed to measure tenth grade achievement and cognitive growth between 1988 and 1990 in the subject areas of mathematics, science, social studies (history/citizenship/geography), and reading. The student questionnaire collected basic background information, and asked students about such topics as their school and home environments, participation in classes and extra-curricular activities, current jobs, their goals and aspirations, and opinions about themselves. Also, as in the base year, two teachers of each student were asked to complete a teacher questionnaire. The teacher questionnaire sought evaluations of the sampled student, class-specific information, school level information about institutional climate and policies, and information about the teacher's background and activities. With its ratings of individual students and class-level information about students' exposure to curriculum content and instructional practices, the teacher questionnaire provides a powerful measure of the specific learning environment of each NELS:88 student. In addition, a school administrator questionnaire was completed by principals. If a student was a first-time participant in NELS:88, he or she also completed a new student supplement, containing questions on basic demographic information which were asked in the base year but not repeated in the first follow-up.

In addition to surveying students who were enrolled in school, the first follow-up also surveyed and tested youths who had dropped out of school at some point between the spring term of the 1987-88 school year and that of the 1989-90 school year. The dropout questionnaire collected information on a wide range of subjects, including reasons for leaving school, school experiences, absenteeism, plans for the future, employment, attitudes and self-concept, and home environment.

The selection of students was implemented in two stages. The first stage of sampling involved the selection of 21,474 students who were in the eighth grade NELS:88 sample in 1988. These students were termed "core" students. The core student sample was then augmented through a process called "freshening", the aim of which was to provide a representative sample of students

Figure 1 Research design for the NCES National Education Longitudinal Studies program



NLS-72 = National Longitudinal Study of the High School Class of 1972
- BY = Base year data collection
- FU1 = First follow-up data collection
- FU2 = Second follow-up data collection
- FU3 = Third follow-up data collection
- FU4 = Fourth follow-up data collection
- FU5 = Fifth follow-up data collection
- M = Maintenance of address data
- PST = Postsecondary education transcripts
- T = Cognitive test administration

HS&B = High School & Beyond: 1980
- BY = Base year data collection
- FU1 = First follow-up data collection
- FU2 = Second follow-up data collection
- FU3 = Third follow-up data collection
- FU4 = Fourth follow-up data collection
- HST = High school transcripts
- M = Maintenance of address data
- PAR = Survey of parents
- PST = Postsecondary education transcripts
- SFA = Student financial aid records
- T = Cognitive test administration

NELS:88 = National Education Longitudinal Study of 1988
- BY = Base year data collection
- BYI = Base Year Ineligible Study
- FU1 = First follow-up data collection
- FU2 = Second follow-up data collection
- FU3 = Third follow-up data collection
- HST = High school transcripts
- O&E = Course offerings and enrollment data
- PAR = Survey of parents
- SCH = School administrator survey
- SEA = School Effects Augmentation
- T = Cognitive test administration
- TCHR = Survey of teachers

enrolled in the tenth grade in the 1989-90 school year. This "two-stage" sampling design differs substantially from the two-stage design employed in the base year. Unlike the sampling design of the first follow-up, in the base year, eighth grade schools formed the primary sampling units, and a random sample of students within schools formed the second stage units. Consequently the base year provided representative samples of both eighth-grade students and schools, allowing for the use of both data files as stand-alone datasets. In the first follow-up, only the student dataset constitutes a representative probability sample. Freshening added 1,043 eligible tenth graders who were not contained in the base year sampling frame, either because they were not in the country, or were not in the eighth grade in the spring term of 1988.[3]

The initial data collection period for the first follow-up was from late January to July, 1990. At the end of this period, the pool of nonrespondents (for example, students who had not attended the survey session or had not been located), which was believed to possibly contain "hidden" dropouts, was subsampled and further pursued in a second data collection effort. Figure 2 outlines the sample and subsamples of the first follow-up; data collection results are presented in Table 1.

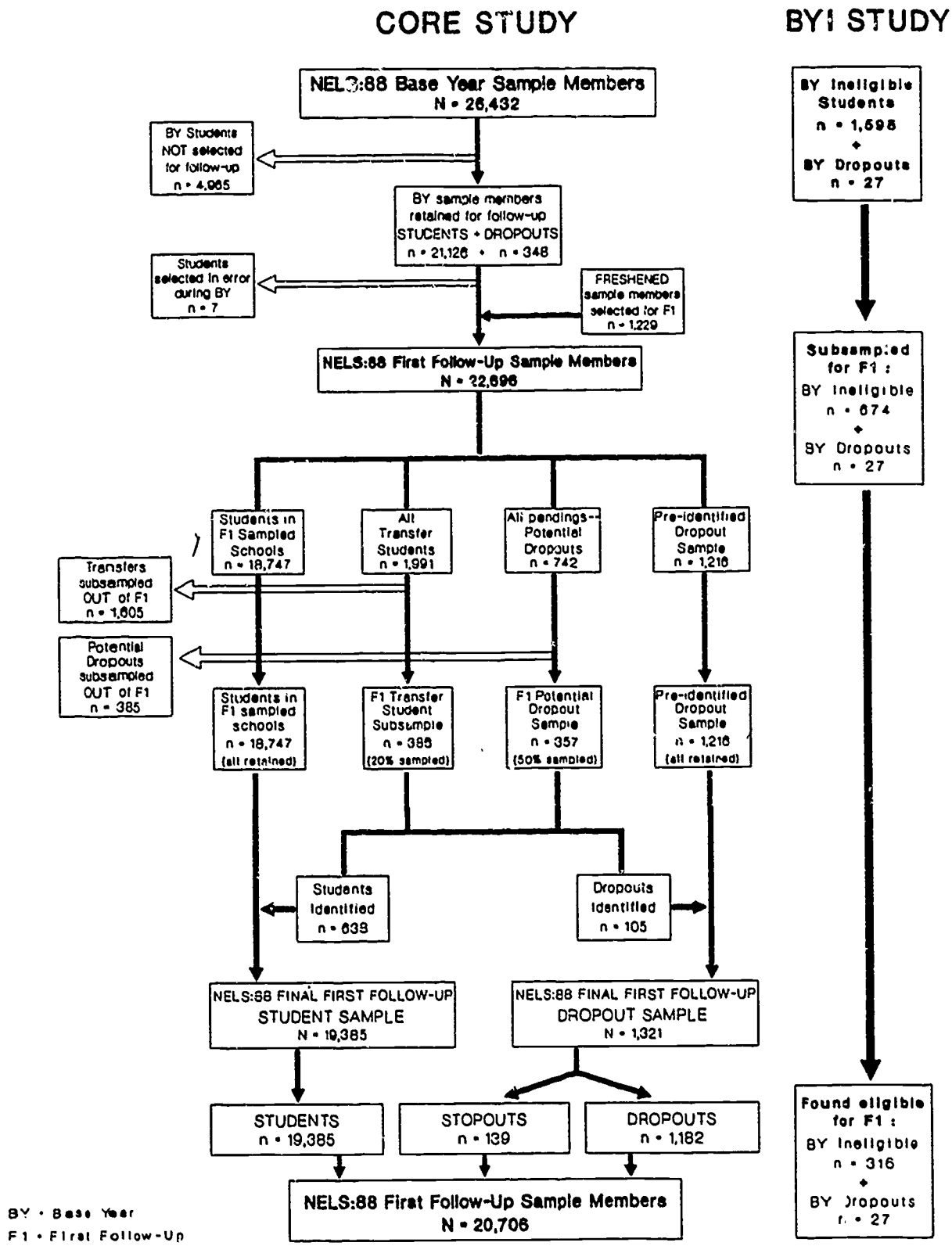
Table 1
Summary of District and School Contacting and Survey Component Completion Rates

	Contacted/Completed	Weighted	Unweighted
Contacting			
District	82	NA	99.2%
Public			
Catholic/ Other Private	58	NA	100.0%
School			
Public	1,100	NA	99.2%
Catholic/ Other Private	247	NA	99.2%
Instruments			
Student questionnaire	18,221	91.12%	94.18%
Student tests	17,352	94.14%	95.23%
Dropout questionnaire	1,043	90.97%	89.84%
Dropout tests	522	48.56%	50.05%
School administrator questionnaire*	17,663	91.97%	96.94%
School administrator questionnaire**	1,291	NA	97.07%

*Percentage of students for whom school administrator data are available.
**Percentage of schools at which the principal completed the questionnaire.

[3] Additional information about the first follow-up sample design is provided in the *NELS:88 First Follow-Up Student Component Data File User's Manual* and the *NELS:88 First Follow-Up Final Technical Report.*

Figure 2: NELS:88 first follow-up sample selection outline



1.2.2 Design Enhancements

Two supplemental studies were undertaken in the first follow-up essentially to compensate for limitations in the NELS:88 design. At selected schools in the 30 largest MSAs, initial first follow-up student clusters were augmented to obtain a representative in-school sample of sufficient size (approximately 30 students) to sustain analyses of school effects (and use of multilevel statistical techniques (for example, hierarchical linear modeling). The data collected for the School Effects Augmentation is not included on the combined base year-first follow-up release but will be made available after the completion of the second follow-up as a 1990-1992 combined data release.

The second supplemental component was the Base Year Ineligible Survey. Owing to a physical or mental disability or insufficient knowledge of the English language such that completion of a self-administered survey form would be unduly difficult or impossible, approximately 5 percent of the population of students enrolled in eighth grade in 1988 were excluded from the base year survey. Exclusion of such individuals from the sampling frame results in significant undercoverage of those subpopulations who are most likely to experience difficulty in school, and to drop out of school. Also because change over time in eligibility status is possible (for example, a student not proficient in English may become so), excluded students, if their status is not reassessed as an adjunct to the freshening process, undermine the tenth and twelfth grade representativeness of the 1990 and 1992 samples. A followback study of base year ineligibles was therefore undertaken in the first follow-up, to reassess eligibility and ascertain 1990 enrollment status.

Individuals who were found to be capable of completing first follow-up survey forms under normal conditions were "brought back into the study" and surveyed. Individuals who were found to be still incapable of participation were assessed with respect to their enrollment and this information for both newly eligible and ineligible individuals was used to derive an expanded sample national dropout rate for the eighth grade cohort of 1988[4] (more is said about the expanded sample dropout rate in section 1.2.3).[5]

1.2.3 First Follow-Up Populations

Two objectives guided the first follow-up sampling plan. First, the sample was to include approximately 21,500 students who were in the eighth-grade sample in 1988 (both participants and nonparticipants). Second, the sample was to constitute a valid probability sample of all students currently enrolled in the tenth grade in the 1989-1990 school year. This entailed freshening the

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[4] For expanded cohort dropout rates reported by respondent gender and race/ethnicity, and by respondent's base year school control type, region and urbanicity, see Kaufman, P., McMillen, M., & Whitener, S.D. (1991). Dropout Rates in the United States: 1990. Washington, D.C., National Center for Education Statistics. (NCES 91-053).

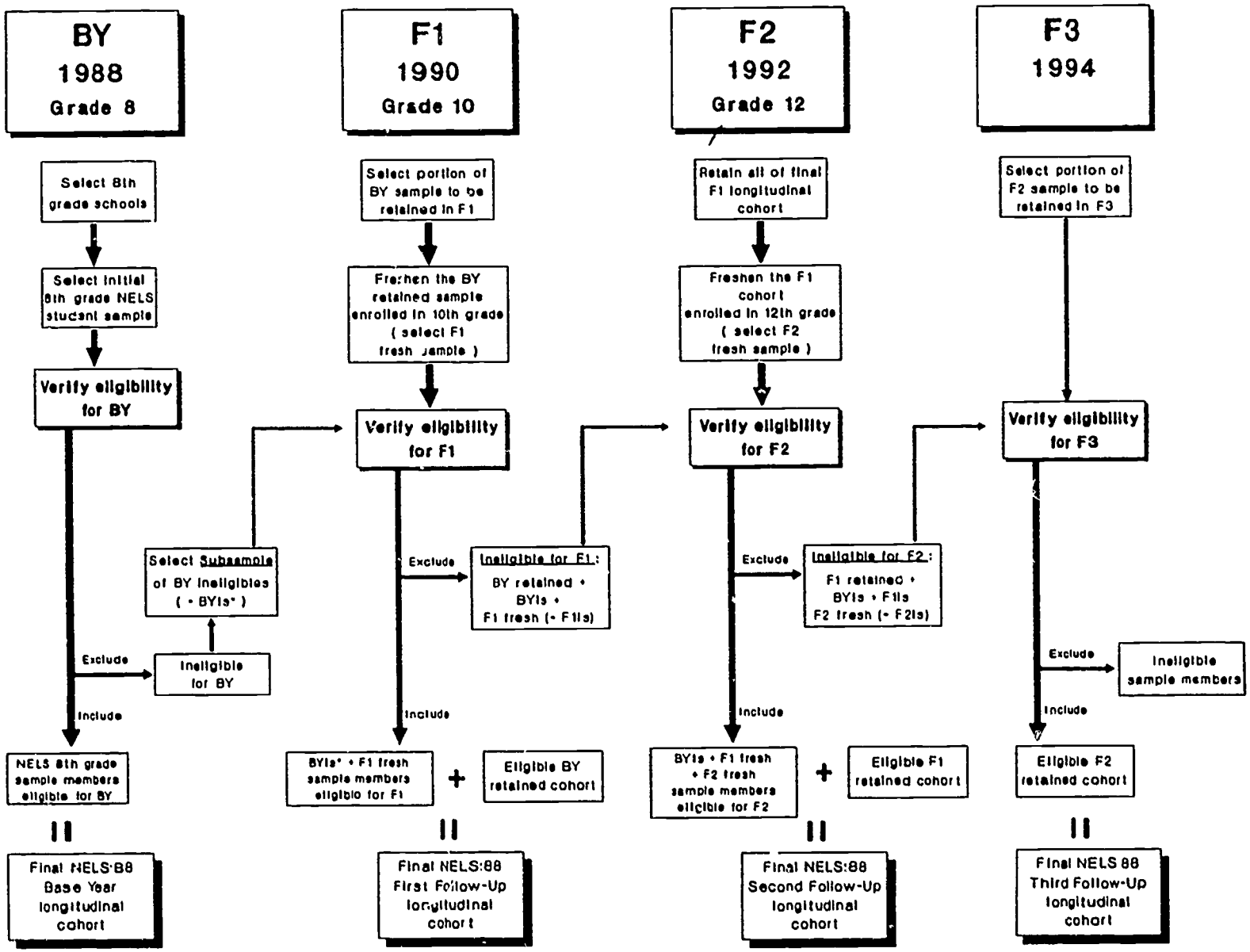
[5] Some 343 base year ineligible sample members (out of a total sample of 674) who were found eligible to participate in the first follow-up are also not included on the combined base year-first follow-up data tape; these cases will be made available on the combined base year/first follow-up/second follow-up data file after the completion of the second follow-up. Also not included on the combined base year-first follow-up data file are data and weights for deriving the expanded sample national dropout rate. Sampling and data collection procedures for the Base Year Ineligible Study are reported in the *NELS:88 First Follow-Up Student Component Data File User's Manual* and *NELS:88 First Follow-Up Final Technical Report.*

sample with students who were tenth graders in 1990 but not in the eighth grade during the 1987-1988 school year. (Figure 3 illustrates the longitudinal sample design of the baseline and follow-up surveys.) The two sampling objectives of the first follow-up produced two primary analytic populations. Both analysis populations are employed in this paper--the NELS:88 eighth grade cohort two years later (1990), and the NELS:88 sophomore cohort of 1990. These populations are illustrated below:

ANALYSIS POPULATIONS FOR THIS PAPER

PANEL ANALYSES:	*CROSS-SECTIONAL ANALYSES*
1988 8th Graders Two Years later	Sophomores in the Spring Term of 1990
Populations:	**Populations:**
Enrolled in school-- tenth grade or another grade	1988 8th Graders in 10th grade in spring term 1990
Not enrolled in school	Freshened students: spring 1990 10th graders who were not 8th graders in the 1987-88 school year. (Added to ensure 1990 NELS:88 10th grade representativeness).
Analyses:	**Analyses:**
TRANSITIONS	BACKGROUND, CURRICULUM, INSTRUCTION, 10TH GRADE MATH ACHIEVEMENT
1. dropout rates 2. student perceptions of difficulty of transition 3. movement between public and private schools, 1988-1990	1. Math test results by background characteristics and curriculum and instructional factors 2. Univariate distributions of student reports of math class practices and emphases, and of math coursework

Figure 3: Longitudinal sample design of NELS:88



The two primary populations of the first follow-up are the eighth grade longitudinal cohort, for whom two waves of survey data have been gathered, and the 1990 tenth grade sample or the sophomore class of 1990. Although the majority of the members of the sophomore class of 1990 are also members of the eighth grade longitudinal cohort--those eighth grade longitudinal cohort members who were attending tenth grade as of the spring term of 1990--the 1990 sophomore cohort, has only one wave of survey data. It is the eighth grade longitudinal cohort members for whom analyses of change and stability between 1988, as eighth graders, and 1990, as students and dropouts, can be performed. Table 2 presents basic demographic characteristics of the two primary populations of the first follow-up.[6]

The 1990 eighth grade longitudinal cohort represents the population of 3 million adolescents who were enrolled in eighth grade two years ago in 1988. Simply put they are the eighth grade class of 1988. Thus, as in the base year, about half of the 1990 eighth grade longitudinal cohort is male and half female. Similarly, the racial/ethnic composition of this cohort in 1990 is the same as the racial/ethnic composition of this cohort in the base year. As displayed in Table 2, 3.6 percent of the 1990 eighth grade longitudinal cohort are of Asian origin, 10.4 percent are Hispanic, 13.2 percent are black, 71.4 percent are white, and 1.4 percent are American Indian or Alaskan Native.

However, unlike the base year, the 1990 eighth grade longitudinal cohort two years later is composed of both students and dropouts. As of spring 1990, 89 percent of the eighth grade longitudinal cohort were enrolled in tenth grade, close to 5 percent were enrolled in a grade other than tenth (either held back or promoted ahead of their class)[7] and 6 percent had dropped out (more will be said on this group later in this section). It is this vast majority of the 1990 eighth grade cohort members (89%)--those who were in enrolled in tenth grade as of spring 1990--who make up the largest portion of the 1990 tenth grade cross-sectional cohort.

The 1990 tenth grade cross-sectional cohort represents the more than 2.8 million students who, in the spring of 1990, were sophomores. The first follow-up sophomore class of 1990 comprises those members of the eighth grade longitudinal cohort who were sophomores in 1990 and freshened students. In order to obtain a nationally representative tenth grade cross-sectional cohort, 1990 sophomores not represented by eighth grade longitudinal cohort members who were sophomores, that is, students who were not in eighth grade in the U.S.A. two years ago but who were in tenth grade as of the spring of 1990--were added to the study. Table 2 presents descriptive statistics on the freshened student cohort.

Although freshened students comprise only 4.7 percent of the tenth grade cross-sectional cohort, they differ strikingly from both 1990 eighth grade longitudinal cohort members and 1990 sophomores. Unlike other first follow-up cohort members, the majority (51%) of freshened students are minority (compared to 29% of the eighth grade longitudinal cohort and 28% of 1990

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[6] In Table 2, column variables sum to 100%. Note that for other tables in this paper, it is the row variables that sum to 100%.

[7] For the 5 percent of eighth grade cohort members who had fallen out of modal grade progression, measures were not taken for separately reporting who had been held back and who had been accelerated. It is certain, however, that by farthe greatest numbers of these individuals were grade retained rather than double promoted.

sophomores), male (56 percent versus 50 percent both for the eighth grade iongitudinal cohort and tenth grade cross-sectional cohort); and live in a non-traditional family arrangement (only 46% of freshened students live with their mother and father; approximately 60% of other cohorts members live with their mother and father). In many ways freshened students resemble the demographic profile of early NELS:88 dropouts, the majority of whom have also repeated a grade,[8] and live in a non-traditional family arrangement (only 26% live with their mother and father).

Freshened cohort members are students who were not in eighth grade in the United States two years ago but were enrolled in the tenth grade as of the spring of 1990. The most frequently reported reason for not attending eighth grade in 1988 was being retained a grade (65%)[9], followed by "in another country" (19%), unknown (12%), and accelerated (2%). Being retained a grade is also characteristic of Limited English Proficient (LEP) students; and, LEP students represent 17 percent of the first follow-up freshened cohort. Freshened cohort students may be students who are at risk of dropping out. However, dropouts and freshened students differ on several key characteristics which may operate to lessen the likelihood of dropping out. It is to a description of dropouts that this paper now turns.

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[8] Not reported in this paper are the percentages of dropouts who repeated a grade at least once. Of all eighth grade longitudinal cohort dropouts, 61.2 percent have repeated at least one grade.

[9] Freshening reasons are reported as raw percents of the sample, rather than as weighted population estimates. All percents cited in this paper are weighted percents unless otherwise noted.

Table 2
Composition of the eighth grade longitudinal cohort in 1990 and tenth grade cross-sectional cohort, and the freshened student cohort by selected background characteristics

	8th Gr. Cohort	Freshened Students	10th Gr. Cross-section
Total	3,007,812	131,385	2,823,330
Sex			
Male	50.1	55.5	49.9
Female	49.9	44.5	50.1
Race/Ethnicity			
Asian and/ Pacific Islander	3.6	5.7	3.9
Hispanic	10.4	21.0	10.2
Black	13.2	22.1	12.5
White	71.4	49.2	72.2
American Indian/ Alaskan Native	1.4	1.9	1.2
Family Composition			
Mother & Father	59.8	45.7	62.4
Mother & Male Guardian	13.3	18.0	12.9
Father & Female Guardian	3.4	3.1	3.3
Mother only	15.5	20.5	14.7
Father only	3.1	3.8	3.1
Other relative or nonrelative	5.0	9.0	3.5
F1 School Type			
Public	90.0	97.4	90.1
Catholic	6.1	1.1	6.0
Independent	1.2	.7	1.2
Other Private	2.7	.7	2.7

Table 2
Composition of the eighth grade longitudinal cohort in 1990 and tenth grade cross-sectional cohort, and the freshened student cohort by selected background characteristics--continued

	8th Gr. Cohort	Freshened Students	10th Gr. Cross-section
Total	3,007,812	131,385	2,823,330
F1 Urbanicity			
Urban	27.8	40.3	28.3
Suburban	56.4	51.9	56.3
Rural	15.8	7.8	15.4
School Enrollment Status			
Enrolled in 10th Grade	89.0	78.4	100.0
Enrolled in Grade other 10th	4.6	NA	NA
Dropout*	6.0	21.5	NA

SOURCE: National Education Longitudinal Study of 1988, First Follow-Up Student Survey, U.S. Department of Education, National Center for Education Statistics.

* Freshened dropouts are not included in the figures reported above, which deal with freshened sample members who are part of the NELS:88 sophomore cohort, that is, were enrolled in tenth grade in the spring term of 1990. Nonetheless, the weighted dropout rate for the students brought in through freshening was, between the autumn and spring terms of the 1989-90 school year, 21.5 percent.

Table 3 presents demographic characteristics for eighth grade longitudinal cohort dropouts contrasted against eighth grade longitudinal cohort members who remained in school. As shown in Table 3, approximately 6.1 percent of the eighth grade longitudinal cohort was not enrolled in school as of the spring term of 1990.

The dropout rate of 6.1 percent for eligible 1988 eighth graders in 1990 is just one of two eighth grade longitudinal cohort dropout rates computed in the first follow-up. A second dropout rate shows, for the NELS:88 expanded eighth grade longitudinal cohort between spring term 1988 and spring term 1990, 6.8 percent no longer enrolled in school. The difference between the two rates reflects the difference between membership in the cohort and eligibility for the survey (again, eighth graders deemed incapable of completing the study forms were excluded from the base year, but their school enrollment status was monitored in the first follow-up). Table 4 displays dropout rates for the eligible eighth grade cohort and the expanded eighth grade cohort side by side, with breakdowns by sex and race/ethnicity.

Table 3
Percentage of eighth grade cohort by enrollment status and selected background characteristics

	Dropout	Student
Total	6.1	93.9
Sex		
Male	6.3	93.8
Female	5.8	94.2
Race/Ethnicity		
Asian/Pacific Islander	3.1	96.9
Hispanic	9.2	90.9
Black	9.9	90.0
White	4.9	95.1
American Indian/ Alaskan Native	10.3	89.7
Year of Birth		
1972 or before	33.6	66.4
1973	9.9	90.1
1974 or after	1.6	98.4
Mother's Education		
Less than HS	13.5	86.5
HS Graduate	5.3	94.7
Some College	3.8	96.2
College Graduate	1.1	98.9
Greater than College	4.1	95.9
Don't Know	7.8	92.3
Family Composition		
Mother & Father	2.6	97.4
Mother & Male Guardian	8.6	91.4
Father & Female Guardian	3.9	96.0
Mother only	8.4	91.6
Father only	4.1	95.9
Other relative or nonrelative	32.2	67.8

NOTE: Because of rounding, percentages may not sum to 100 percent.

SOURCE: National Education Longitudinal Study of 1988: First Follow-Up Student Survey, U.S. Department of Education, National Center for Education Statistics.

Table 4
NELS:88 eighth-grade expanded and base year-eligible cohort dropout and retention rates, by sex and race/ethnicity spring term 1990

Selected Characteristics	1988 Expanded* Cohort not enrolled in School	1988-Eligible Eighth Graders not enrolled in school
	(percent)	(percent)
TOTAL	6.8	6.1
SEX		
Male	7.2	6.3
Female	6.5	5.8
RACE-ETHNICITY		
Asian/Pacific Islander	4.0	3.1
Hispanic	9.6	9.2
Black, non-Hispanic	10.2	10.0
White, non-Hispanic	5.2	4.9

*Expanded cohort comprises all 1988-eligible and 1988-ineligible sample members.

Note: Because of rounding, percentages may not sum to 100 percent.

Source: National Education Longitudinal Study of 1988: First Follow-Up Student Survey, U.S. Department of Education, National Center for Education Statistics.

Part 2--Highlights from the First Follow-Up Student Survey

2.1 The Transition from Eighth Grade to High School

One of the key transitions NELS:88 is designed to study is the pattern and consequences of student movement from eighth grade in elementary, middle, or junior high school to high school. The issue is of particular importance because of the need to gain a better understanding of the impact of early elementary school experiences on later educational outcomes. It is necessary both to take into account the schooling that occurred prior to high school, and the impact of the transition itself. It has been suggested, for example, that the singular, and for some students unsettling, act of changing from one school in eighth grade to a new school for high school, may be one of the precipitating factors in dropping out.[10]

In this section we examine **sector change** and general **eighth grade to high school transition**. To begin, basic descriptive statistics are presented on patterns of sector changes for the eighth grade longitudinal cohort. In the subsequent section, eighth grade to high school transition is examined in terms of student reports of how well they weathered the transition to high school.

Sector Changes. Between grades eight and ten, most students do change schools. Not only do they change school buildings, but also they move from elementary, middle, or junior high schools, to high schools that are typically differently structured and often larger in size then their former schools. Between grades eight and ten only a minority of students change school sectors. While for most public or private school students, continuity is maintained, nevertheless, much of the movement that does take place between private and public schools occurs at this transition point.

-As of 1990, two years after eighth grade, nine out of ten 1988 eighth graders were attending a public sector school. Of the three types of private sector schools NELS:88 examines--Catholic, independent, and other private[11]--6.1 percent of the cohort were attending a Catholic high school, 1.2 percent were attending an independent high school and close to 3 percent were enrolled in an other private high school. These first follow-up percentages closely match the percentages reported for the types of schools the longitudinal cohort attended in 1988[12].

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[10] Roderick, M. (1992). School transitions and school dropout: Middle school and early school antecedents to school leaving. Unpublished manuscript currently under editorial review.

[11] As in the base year, the first follow-up attempted to capture the variation in private sector schools. The private school sector categorized as "independent" refers to schools which are members of the National Association of Independent Schools (NAIS). These schools have a strongly academic orientation and are primarily nonsectarian, but include some schools with an explicit religious orientation or affiliation. The "other private" category refers to private schools that do not classify themselves as either Catholic or independent. The types of schools included in this category are Lutheran, fundamentalist Christian academies, and Jewish schools, as well as nonsectarian non-NAIS institutions.

[12] In eighth grade, 87.9 percent of the eighth grade longitudinal cohort attended public school, 7.5 percent attended Catholic school, 1.0 percent attended an independent school and 3.6 percent attended an other private school.

Overall, an overwhelming 93 percent of cohort students did not change sectors between 1988 and 1990. Of those who changed, however, 4.5 percent transferred from a private sector eighth grade school (either Catholic, independent or other private) to a public sector high school, and slightly less than 2 percent changed to another private sector high school (e.g., changed from the Catholic sector to the independent sector). The fact that 93 percent of the student cohort did not change sectors between 1988 and 1990 may be somewhat misleading since in eighth grade 87.9 percent of the cohort attended a public sector school. Movement of students out of the three private school sectors was nonetheless considerable--especially movement from private to public schools.

While overall only 7 percent of the cohort changed sectors between 1988 and 1990, as shown in Table 5 (on an individual sector basis and including changes across the different types of private sectors, e.g., other private to independent), 40 percent of cohort students who attended the Catholic sector in eighth grade, 44 percent of cohort students who attended the other private sector in eighth grade and 25 percent of cohort students who attended an independent sector school in eighth grade transferred to another sector for high school.

Table 5
Percentage of eighth grade longitudinal cohort who changed school sectors from middle or junior high school to high school

	Tenth Grade Sector			
	Public	Catholic	Independent	Other Priv.
Eighth Grade Sector				
Public	98.03	1.14	.29	.54
Catholic	36.94	59.68	2.17	1.20
Independent	14.98	6.53	74.40	4.10
Other Private	37.20	6.62	0.00	56.19

Note: Because of rounding, percentages may not sum to 100 percent.

Source: National Education Longitudinal Study of 1988: First Follow-Up Student Survey, U.S. Department of Education, National Center for Education Statistics.

Of greater interest is the proportion of cohort students who left the private sector after eighth grade to attend the public sector for high school. Of all the cohort students who attended the private sector for eighth grade and who changed sectors, the greatest migration was to the public sector. Indeed as shown in Table 5, 37.2 percent of the student cohort attending the other private sector in eighth grade, 36.9 percent of the cohort enrolled in the Catholic sector in eighth grade and 14.9

percent of the student cohort attending the independent sector in eighth grade left their respective eighth grade sectors for the public sector.

There are many further questions--which we do not address in this paper--of interest concerning transitional sector change, such as why students change from the private to public sector and with what effect, and what characteristics differentiate the students who change from those who do not. NELS:88 data can provide some evidence in answer to these questions, though it should be remembered that because of subsampling of small clusters between the base year and first follow-up, rarer transition patterns such as movement from public to private schools are represented by greatly reduced numbers of such cases retained in the first follow-up.

Eighth Grade to High School Transition. The transition from elementary to high school, similarly to the transition from elementary to middle or junior high school has, for some students, been found to be associated with a general decline in school performance, such as a drop in extracurricular activities, GPA, math scores and particularly among girls, self-esteem.[13] The numerous school-related behavior and performance measures collected in the first follow-up enable continued investigation of the effects of the eighth grade to high school transition on student high school performance. To obtain some sense of how well the eighth grade longitudinal student cohort weathered the transition to high school, we examine students' reports on how difficult they felt the first year of high school was relative to eighth grade.

In the first follow-up the eighth grade student cohort was asked to report on how difficult the first year of high school was compared to the year before. Table 6 reports percentages of students who agreed, on a number of dimensions, that the first year of high school was more difficult than the preceding year. For the majority of the eighth grade longitudinal student cohort, the first year of high school was more difficult than the year before. Indeed, almost 3 out of 4 students agreed that courses were harder the first year of high school than the year before. More than half reported that teachers were more strict (55.0%) and that rules were more strictly enforced (56.0%). Fewer reported social adjustment problems. Students were asked if they agreed with the statement it was "more difficult to make friends in high school" and "I feel more alone in high school." For both items, about 1 out of 5 students agreed that it was more difficult to make friends (19.3%) and they felt more alone (19.1%) the first year of high school than they did the year before.

The fact that close to three-fourths of the student cohort felt that first year high school coursework was more difficult than eighth grade coursework is especially noteworthy. One of the objectives of the grade-level based education system is to ready students at each grade for the material and coursework of the next grade. Thus, it is surprising to find that such a substantial number of students found the first year of high school to be more difficult than eighth grade. It is unclear from simple tabular data whether this perception on the part of students reflects an objectively more demanding intellectual environment, or the effects of the strains and stresses of transition to a new environment, or both.

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[13] Blyth, D. A., Simmons, R. G. & Carlton-Ford, S. (1983). The adjustment of early adolescents to school transitions. Journal of Early Adolescence, 3(1 & 2), 105-120. Simmons, D. A., Rosenberg, M., & Rosenberg, F. (1973). Disturbance in the self-image at adolescence. American Sociological Review, 39, 553-568.

Table 6
Percentages of eighth grade cohort students who agreed that the first year of high school was more difficult in various ways than the year before

ACADEMIC AND SCHOOL DISCIPLINARY FACTORS	%
Courses are harder in high school	72.65
Teachers are more strict in high school	55.03
Rules are more strict in high school	56.05
SOCIAL FACTORS	**%**
It is more difficult to make friends in high school	19.35
Feel more alone in high school	19.11

We have sketched some basic aspects of the transition of eighth graders to high school--specifically, their rates of persistence and nonpersistence in school, their school mobility seen in terms of changes between public and private schools or different types of private schools, and their assessment of whether high school is, in academic and social terms, more difficult than eighth grade. We now would like to turn from the analysis of 1988 eighth graders two years later to a different analysis population--spring term 1990 sophomores. Some findings on the topic of instruction and achievement in mathematics will illustrate how this analysis population may be employed. Again, while 1988 eighth graders who dropped out of school and students who progressed more slowly or quickly than their peers are included in the longitudinal analyses of transitions, our analysis of learning and achievement will be limited to tenth graders. At the same time that some members of the eighth grade cohort will be excluded from the analyses, an additional population--freshened students--will be added in, to ensure that our conclusions are generalizable to sophomores as a whole, in the United States in the spring term of the 1989-90 school year.

2.2 Instruction and Achievement

Mathematics achievement and standards are of national interest, this interest spurred in part by a drive to be competitive in a global economy, and evidence of lagging performance of American students on the mathematical components of international assessments.

In response, efforts at school improvement--in particular, such reforms as increasing the amount of coursetaking in key areas such as mathematics, making the content of such courses more

rigorous, and improving the methods by which such courses are taught--have been a prominent feature of the years in which NELS:88 sample members passed through middle and junior high schools and on into high school. It is therefore of particular interest to examine how much American tenth graders have achieved in mathematics, what sociodemographic characteristics mark differences between those who have high achievement levels and those who do not, and to examine the extent to which changes that have or can be made to occur in the learning environment may promote more effective schools and, in turn, improved mathematics learning.

An examination of three facets of the school experience and achievement of 1990 sophomores in mathematics will serve to illustrate the kinds of questions and issues that NELS:88 data can illuminate. First, it will be of interest to examine **the math courses that sophomores have taken since eighth grade**. Although most sophomores are still enrolled in math, there is great variation in the kind of mathematics courses they have taken. In turn, there are also important differences in the rigor or academic content found across the diversity of mathematics courses that sophomores have been exposed to.

Second, it will be of interest to examine student reports of the **instructional practices** or activities that are employed in their classrooms and the resources available to support those practices, as well as reports of sophomores' perceptions of what **objectives** their teachers emphasize in class. The 1989 National Council of Teachers of Mathematics professional standards for mathematics instruction provide a model of reformed mathematics instruction. NELS:88 data provide a 1990 benchmark for gauging the pace and direction of instructional change in future years, complemented by 1990 NAEP data[14] on other grade levels.

Third, it will be of interest to examine **mathematics achievement**, as measured by the NELS:88 cognitive test battery, in relation to such **student background factors** as sex and race, family socioeconomic status, and control type of school attended. Likewise, it will be of interest to examine mathematics achievement in relation to alterable **curricular and instructional factors**, such as amount of advanced math coursework taken, and the teacher's instructional techniques and classroom emphases.

COURSE-TAKING.

Even though course titles can mean different things in different schools, and content for courses with the same names may vary considerably from place to place, course enrollment reports do provide an approximate measure of exposure to mathematical contents and concepts. The general tendency of school reform has been to de-emphasize electives and place added emphasis--both in terms of numbers of courses taken and the rigor of the content of those courses--on academic subjects such as mathematics. Indeed, by the spring of 1985, 41 states had raised their standards for high school graduation (Goertz, 1986), with math one of the subjects most affected by increased

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[14] Teacher and student data from the 1990 NAEP point to largely similar findings for eighth graders concerning use of calculators and computers in math classrooms and about use of instructional materials and resources. See Mullis, I., Dossey, J., Owen, E., and Phillips, G. The State of Mathematics Achievement: Executive Summary. 1991. Washington, D.C.: National Center for Education Statistics.

requirements. Over and beyond what may be required as a minimum for graduation in any given state, the National Council of Teachers of Mathematics recommends three years of mathematics courses be completed by every high student, regardless of ability level, with a fourth year recommended for the college-bound.

In 1988, the majority of eighth graders (58 percent) were enrolled in regular math, with about a third enrolled in more demanding math courses such as pre-algebra or algebra, and 5 percent in remedial math.[15]

In 1990, the overwhelming majority of tenth graders are enrolled in math (between 3 and 4 percent of sophomores report that they were not enrolled in mathematics in the 1989-90 school year). The fact of widespread enrollment in math cannot automatically be assumed to reflect a high level of commitment to mathematics learning, as evidenced behaviorally by factors such as time spent in homework or out of class study.[16] Nonetheless, past studies have demonstrated that there is a strong positive relationship between the quantity of coursework taken and achievement.[17] While there is little variation in whether sophomores are taking mathematics, there is great variation in the kind of math they have taken since leaving eighth grade. If the quantity of mathematics taken is important, so too the kind of mathematics--for example, how much **advanced** coursework has been taken--is also important.

Although the high school math curriculum oftentimes is not explicitly tracked by course level into the regular, remedial and advanced courses that are typical at eighth grade, the diverse math courses offered in high school are associated with a range of contents and levels of cognitive demand. Some high school students take a general mathematics sequence and others a college-preparatory sequence. Hence some tenth graders have been enrolled in less intellectually demanding mathematics courses such as general math, while others have taken algebra, geometry, or advanced math courses. As can be seen from the student questionnaire response frequencies below, around half of tenth graders had not taken geometry by spring term of sophomore year, and over thirty percent had taken no algebra, while around 62 percent had completed at least a year of algebra. Very few have taken advanced math courses such as trigonometry, pre-calculus or calculus at this stage in their high school careers.

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[15] Hafner, A., Ingels, S., Schneider, B., and Stevenson, D. (1990). A Profile of the American Eighth Grader. Washington, D. C., National Center for Education Statistics. (NCES 90-458).

[16] Needless to remark, the fact of enrollment in a course does not automatically ensure either that teachers will make exacting demands or that students will exhibit a high level of commitment to mastering its contents. The fact that of sophomores who are enrolled in mathematics, over 70 percent report that they spend between 0-1 hour on math homework in school per school, and over 60 percent report that they spend between 0-1 hour on math homework outside school each week underscores this fact with some force. However, amount of math homework should be viewed in the context of total homework. (Only about half of all sophomores indicated completing five or more hours of homework in all subjects combined, both in and out of school.)

[17] See, for example, Sebring, P.A., 1987--"Consequences of Differential Amounts of High School Coursework: Will the new graduation reuirements help?" in Educational Evaluation and Policy Analysis, 9(3), 258-273; and Schmidt, W.H. 1983--"High School Coursetaking: Its relationship to achievement." Journal of Curriculum Studies, 15(3), 311-332.

TABLE 7: Self-Reported Ninth and Tenth Grade Academic Coursework Taken by Spring Term 1990 Sophomores

MATH	None	1/2 year	1 year	>1 year
General Math	69.4	3.2	17.4	10.1
Pre-Algebra	66.1	5.8	24.7	3.3
Algebra I	31.2	6.9	56.1	5.9
Geometry	49.6	5.1	43.9	1.5
Algebra II	73.2	4.6	21.5	.7
Trigonometry	92.7	3.8	3.1	.5
Pre-Calculus	97.7	.9	1.1	.2
Calculus	98.2	.5	.9	.3
Business Math	.90.0	2.9	6.1	1.1
Other Math	91.1	2.2	4.7	1.9

Instructional practices. Because classroom practices are manipulable--that is, the classroom strategies and behaviors of teachers can be changed and their resources altered or augmented--there has been keen interest in whether instruction can be improved so that students learn more effectively. In mathematics, as noted earlier in this report, there have been major recent initiatives by the National Council of Teachers of Mathematics[18] (NCTM) designed to identify and encourage desirable changes in instructional practices for school mathematics.

The NCTM standards place heavy emphasis on problem solving, and on learning to reason and communicate mathematically. They are designed to encourage teachers to help students actively assimilate mathematical knowledge and experiences and construct their own meanings. A major goal of the recommended mathematics curriculum is to establish vividly for all students the connections between school mathematics and real-world applications of the discipline and to instill the power of mathematical reasoning and communication in all learners. In terms of instructional practices in high school mathematics, the standards imply decreased attention to some kinds of practices and increased attention to others[19], as summarized below:

Decreased attention:

- teacher and text as sources of knowledge
- rote memorization of facts and procedures
- instruction by teacher exposition

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[18] NCTM (National Council of Teachers of Mathematics). 1989. Professional Standards for Teaching Mathematics. Reston, Virginia: Author. Also see Curriculum and Evaluation Standards for School Mathematics. 1991. Reston, Virginia: National Council of Teachers of Mathematics.

[19] A more complete summary of recommended changes in instructional practices may be found in the 1989 NCTM Standards (op. cit.), p. 129.

. paper and pencil manipulative skill work

Increased attention:

. problem solving as means and goal of instruction

. active involvement of students in mathematical thinking and its application

. promotion of student interaction, e.g. through questioning

. use of calculators and computers as tools for learning and doing math

. written and oral student communication of mathematical ideas

To be sure, if these emphases and practices were already widespread, there would be little point to encouraging them as reforms. However, it is of interest to establish a baseline that measures the degree to which these recommended changes in instructional emphasis depart from the reality in the contemporary classroom. And it will be of further interest to measure progress toward the new standards over coming years, as well as their effect on the mathematics achievement of American students. The table below depicts the reported frequency of selected practices and uses of resources in the mathematics classrooms of America's 1990 sophomores:

Table 8
Univariate Distributions of Student Reports of Math Class Activities and Resources

In your most recent or current MATH class, how often do/did you:

	NEVER	SOME-TIMES	OFTEN
ACTIVITIES:			
Review the work from the previous day?	7.7	33.3	59.1
Copy the teacher's notes from the blackboard?	18.1	34.2	47.7
Do story problems or problem-solving activities?	18.3	51.4	30.4
Participate in student-led discussion?	40.8	39.6	19.6
Explain your work to the class orally?	39.0	37.1	23.9
RESOURCES:			
Use books other than text books?	70.4	18.2	11.3
Use computers in math class?	84.2	12.6	3.2
Use hands-on materials or models	60.8	25.2	5.9
Use calculators	28.3	37.5	34.2

SOURCE: National Education Longitudinal Study of 1988: First Follow-Up Student Survey, U.S. Department of Education, National Center for Education Statistics.

The general picture reported by sophomores is that current practices are very far from those recommended by NCTM. This generalization holds true whether we look at classroom activities or resources.

Activities. In terms of activities, while the new mathematics instructional standards emphasize problem-solving and real-life contextualization of math problems, only thirty percent of sophomores often engage in problem-solving activities. While the new standards emphasize student discussion and oral explanation, substantial numbers of students report no exposure to such activities in their classrooms (approximately 41 percent report they never participate in student-led discussions in math class, while 39 percent of sophomores report that they never explain their work to the class orally).

Resources. NELS:88 data suggest that American high schools have a good way to go before approaching or meeting the standards for access to and use of mathematical resources. While the NCTM standards recommend the use of books other than math text books, seventy percent of American sophomores report that they never use books other than texts. Nor do most students report using hands-on materials or models. A major emphasis of the standards is on use of computers and calculators. Nevertheless, 84 percent of sophomores report never using computers and only 3 percent report frequent use. Even for the case of the ubiquitous, easy-to-use and relatively inexpensive calculator, over a quarter of the nation's sophomores report that they never use calculators in their math class, while just over a third report that they use calculators in class frequently.

Instructional Objectives: Classroom Emphases

The NCTM standards suggest that certain objectives should be emphasized to a greater degree than others. While memorizing math facts and procedures is important, the standards suggest that memorization may be over-emphasized at present relative to such other important goals as problem-solving. Additionally, the standards offer that greater emphasis should be given to showing the way that math connects with the problems of everyday life.

The table below summarizes sophomores' reports on what teachers emphasize in their mathematics classrooms. It is important to note that these are student perceptions of what the teacher is stressing, and may or may not agree with the teacher's notion of what is being emphasized.[20]

[20]Teacher reports on what is emphasized in the classroom may differ from student reports, either because teachers have a more sophisticated understanding of their classroom goals, or because of social desirability biases in behalf of what teachers feel they should be teaching, or for any of a number of other reasons. In the NELS:88 teacher questionnaire, mathematics teachers were asked how they use various teaching methods, and how much emphasis they give various objectives. When the first follow-up teacher data become available for analysis, it will be instructive to compare teacher and student reports of instructional practices and emphases.

Table 9

Univariate Distributions of Student Reports of Degree of Emphasis Accorded Various Mathematics Classroom Objectives

In your most recent or current mathematics class, how much emphasis does/did the teacher place on the following objectives?

	None	Minor Emphasis	Moderate Emphasis	Major Emphasis
Increasing your interest in math	14.9	27.8	34.5	22.8
Learning and memorizing math facts, rules, and steps	4.2	12.8	30.1	52.9
Preparing you for further study in math	7.1	15.9	33.8	43.2
Thinking about what a problem means and the ways it might be solved	5.0	11.9	30.9	52.2
Showing you the importance of math in daily life	13.9	26.6	29.7	29.8

SOURCE: National Education Longitu nal Study of 1988: First Follow-Up Student Survey, U.S. Department of Education, National Center for Education Statistics.

Interestingly, students seemingly perceive both memorization of facts and procedures and problem solving as comparatively highly emphasized aspects of their instructional programs. Over half of sophomores agreed that these two objectives were major emphases; only around 17 percent felt that these two objectives received no emphasis or minor emphasis. In light of these perceived emphases, it is surprising to recall that Table 8 indicated that only 30 percent of sophomores report that they often do problem solving activities in the classroom--51 percent do problem solving only sometimes, and 18 percent not at all. It is perhaps noteworthy as well, in light of this perceived emphasis on mathematical problem solving, that national assessments (and international comparisons) point to the fact that while American students perform relatively well on basic computation, their most glaring weaknesses are in mathematical reasoning and problem solving.[21]

While, in the view of students, their teachers are stressing problem solving in the classroom, less than a third of sophomores thought that teachers were putting major emphasis on showing them

[21]See, for example, Mullis, I., Owen, E.H., and Phillips, G.W., 1990. Accelerating Academic Achievement: A Summary of Findings From 20 Years of NAEP. Princeton, N.J.: Educational Testing Service.

the importance of math in daily life, while around 40 percent felt that this objective received little or no emphasis.

In the section that follows--which examines mathematics achievement--we will return to some of the factors discussed in this section, such as emphasis on factual and procedural memorization, emphasis on problem solving, reviewing the work from the previous day--to see whether differences in mathematics achievement are associated with these practices and emphases.

Mathematics Achievement in Relationship to Student Background and Curriculum and Instruction.

The third area of interest that we identified for investigation was the relationship between mathematics achievement and selected student background, curricular and instructional factors. These relationships are depicted in the two tables (Tables 10 and 11) below. Curricular and instructional factors, as we have noted, are alterable, and change in curriculum and instruction has been an imperative of the recent school reform movement. Background characteristics are important to examine too, both for a better understanding of group differences in achievement, and because equity considerations argue for efforts to overcome achievement gaps between groups. While the trend is toward some narrowing of group differences, historically, black and Hispanic students have been less well served by the education system in terms of mathematics learning than have white and Asian students. Important disparities between males and females in mathematics achievement have been observed as well, particularly at the high school level and thereafter.

The first table--Table 10--presents tested mathematics achievement in terms of mastery or proficiency levels. The second table (Table 11) presents mathematics achievement in terms of the mathematics test quartile, which arrays scores from highest to lowest in four equal gradations.

NELS:88 test scores can be reported in various forms, each of which may be useful for a different purpose. Because proficiency scores are available only for mathematics and reading, most tables in this report present test quartiles. Nevertheless, because proficiency scores give additional information--they represent a specifiable level of mastery of mathematics materials--we briefly summarize results (in Table 10 below) by proficiency level, before examining (in Table 11) in more detail mathematics achievement on a quartile basis.

Proficiency score reports assume that skills in mathematics follow a building-block pattern. That is, the skills required to master the basic level are assumed to be necessary to achieve proficiency at the next higher level, and so on until the highest level is reached. The four mastery levels of mathematics proficiency may be defined as follows.

Math Level 1: Simple arithmetical operations on whole numbers

Math Level 2: Simple operations with decimals, fractions, and roots

Math Level 3: Simple problem solving requiring conceptual understanding and/or the development of a solution strategy

Math Level 4: Conceptual understanding and complex problem solving

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Table 10: Proficiency Results by Sociodemographic Variables and School Control

PERCENTAGE OF 1990 SOPHOMORES AT EACH PROFICIENCY LEVEL	BELOW LEV 1	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4
	%	%	%	%	%
TOTAL SAMPLE	11.23	26.53	14.77	25.09	22.38
SEX					
MALE	12.04	24.55	14.95	23.82	24.64
FEMALE	10.41	28.51	14.60	26.36	20.11
RACE/ETHNICITY					
ASIAN	6.63	18.68	8.92	34.75	31.02
HISPANIC	15.74	39.78	15.73	16.63	12.12
BLACK, NON-HISP.	20.18	42.79	16.60	14.59	5.84
WHITE, NON-HISP.	9.14	22.08	14.68	27.65	26.45
SES					
LOW QUARTILE	18.08	43.33	16.44	15.10	7.05
SECOND QUARTILE	13.27	30.43	17.01	24.20	15.09
THIRD QUARTILE	9.85	23.11	16.53	28.67	21.84
HIGH QUARTILE	4.41	12.76	10.20	30.72	41.91
SCHOOL CONTROL					
PUBLIC	11.91	27.62	14.81	24.60	21.05
CATHOLIC	3.71	19.96	15.70	29.31	31.32
INDEPENDENT	5.76	1.11	10.33	18.18	64.62
OTHER PRIVATE	4.96	17.68	12.10	37.66	27.61

SOURCE: National Education Longitudinal Study of 1988: First Follow-Up Student Survey, U.S. Department of Education, National Center for Education Statistics.

Figure 4a

MATHEMATICS ACHIEVEMENT

PERCENT OF 1990 SOPHOMORES AT EACH PROFICIENCY LEVEL

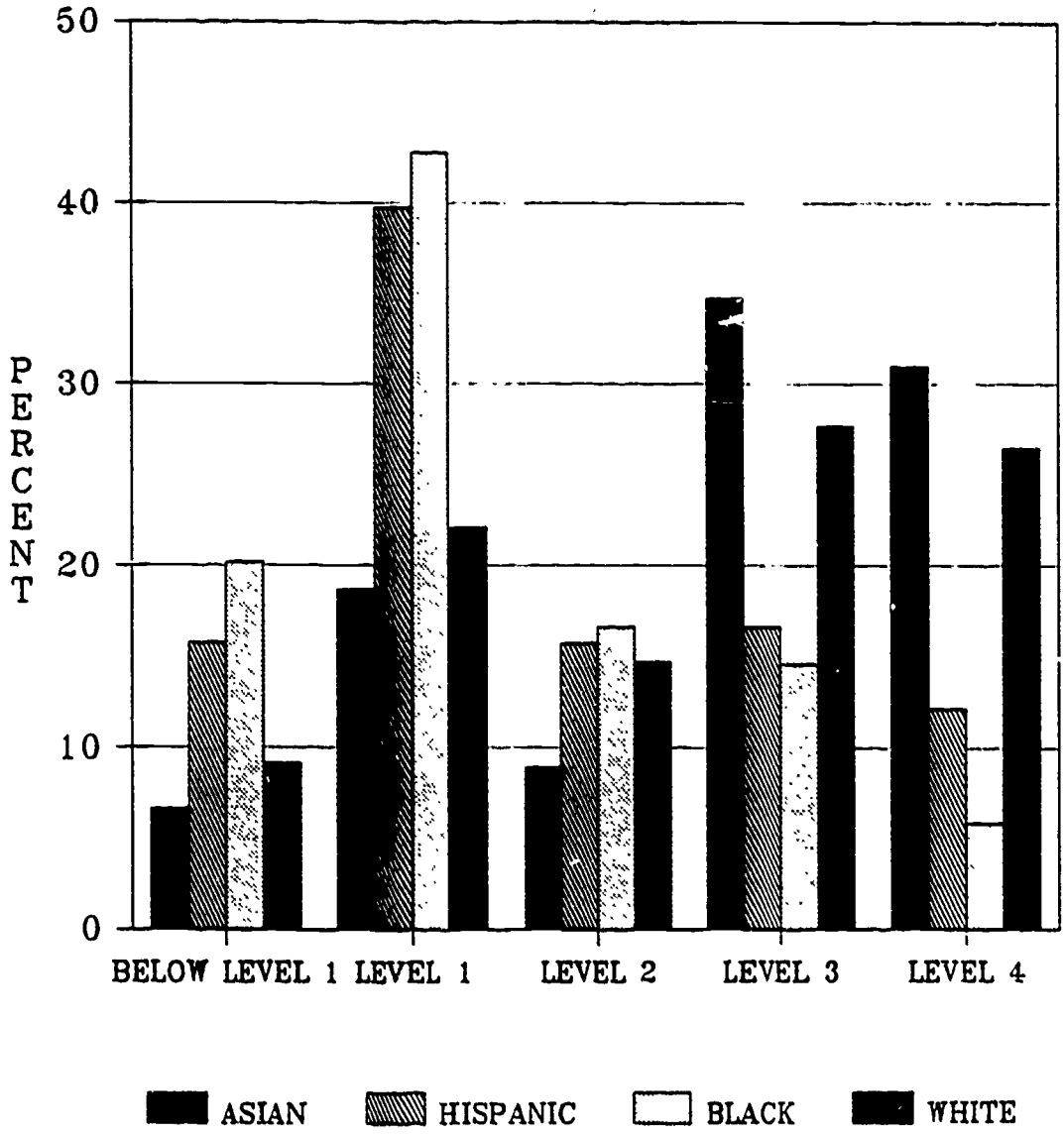
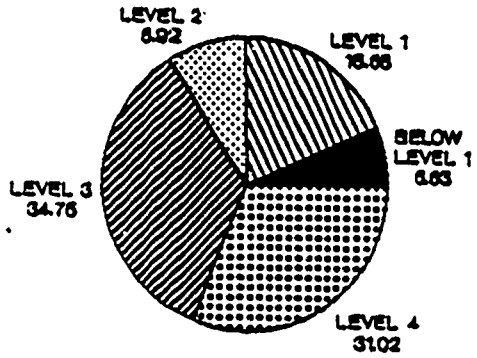


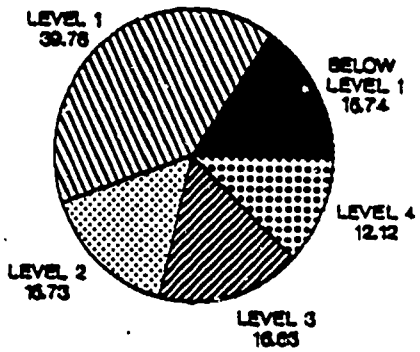
Fig. 4b

MATHEMATICS ACHIEVEMENT

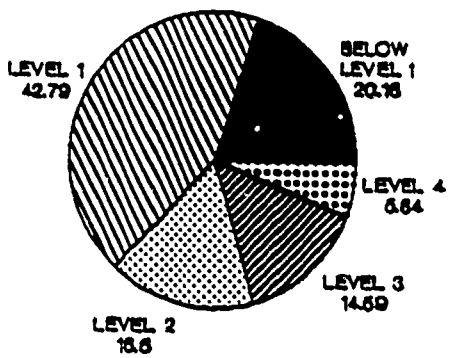
PERCENT OF 1990 SOPHOMORES AT EACH PROFICIENCY LEVEL



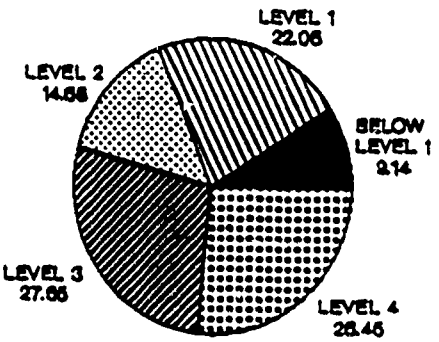
ASIAN



HISPANIC



BLACK



WHITE

The proficiency score results for spring term 1990 sophomores show that:

. **OVERALL:**

--just over 11 percent of sophomores are unable to perform simple arithmetic operations on whole numbers;

--over 26 percent are able to perform simple arithmetical operations on whole numbers but not (Math Level 2) simple operations with decimals, fractions, and roots.

--a further 15 percent are able to demonstrate level 1 and 2 skills, but not perform simple problem solving that requires conceptual understanding.

--about a quarter of spring term 1990 American sophomores have mastered simple problem solving but not (Level 4) complex problem solving.

--finally, just over 22 percent of sophomores show the highest level of mathematics mastery, that is, conceptual understanding and complex problem solving.

. **BY RACE/ETHNICITY:** **whites** and **Asians** were more likely than **black** and **Hispanic** students to have achieved proficiency in problem-solving mathematics skills; see Figure 4.

. **BY SES:** for each sample member, NELS:88 contains a composite measure of **socioeconomic status** (SES) derived from father's and mother's education level, father's and mother's occupation, and family income. When mathematics proficiency scores are viewed in relationship to quartile rankings on the socioeconomic status scale, considerably higher mastery levels are demonstrated by higher SES students:

--42 percent of students in the highest SES quartile achieved mastery of the high-level mathematics skills in problem solving, as contrasted to only 7 percent of the lowest SES quartile students;

--only 4 percent of the highest SES sophomores, but over 18 percent of the lowest quartile sophomores, lacked basic skills.

. **BY GENDER:** **males** were more likely than **females** to have mastered complex problem-solving skills; otherwise, gender differences in mathematics achievement were not statistically significant.

The following table presents math test quartile results by background characteristics, opportunity to learn, and instructional factors.

Table 11

Math Test Quartile by background characteristics, opportunity to learn, and instructional factors.

MATHEMATICS TEST QUARTILE:	Lowest Qtle	22 - 49%	50 - 74%	Highest Qtle
Race/Ethnicity				
Asian/PI	13.8	20.4	26.9	39.0
Hispanic	34.6	32.5	20.2	12.7
Black	41.8	31.6	18.2	8.4
White	16.8	23.5	28.1	31.6
AI/NA	51.8	24.6	16.7	6.9
School Control				
Public	23.3	25.8	25.3	25.7
Catholic	10.2	21.0	34.0	34.8
Independent	5.3	10.0	13.5	71.2
Other Private	9.8	22.4	36.8	31.0
Socioeconomic Status				
Low	40.1	31.3	19.8	8.8
Middle	20.8	28.2	27.5	23.5
High	8.1	15.1	28.7	48.1
Sex				
Male	22.2	24.5	24.8	28.6
Female	21.9	25.9	27.1	25.2
Opportunity to Learn: Math Coursework Level				
Low	55.0	32.7	9.5	2.8
Middle	12.9	27.7	34.9	24.5
Advanced	8.0	12.6	23.3	56.1

Note: Because of rounding, percentages may not sum to 100 percent.

Source: National Education Longitudinal Study of 1988: First Follow-Up Student Survey, U.S. Department of Education, National Center for Education Statistics.

Table 11
Math Test Quartile by background characteristics, opportunity to learn, and instructional factors–continued.

	Lowest Qtle	22 - 49%	50 - 74%	Highest Qtle
Instructional Demand: Asked to Show Understanding in Math				
Not Taking*	42.2	36.6	14.1	7.2
Never Asked	27.6	25.6	28.1	18.3
Less Than Once a Week	21.4	25.1	25.6	27.8
About Once a Week	18.6	24.3	26.2	30.9
A Few Times a Week	19.0	25.0	27.2	28.8
Almost Every Day	22.0	24.7	25.7	27.6
MATHEMATICS TEST QUARTILE: Perceived Instructional and Curricular Emphasis:				
Math Facts/Rules Emphasis				
None	43.3	30.2	18.1	8.4
Minor Emphasis	31.6	28.5	22.6	17.4
Moderate Emphasis	24.1	25.8	25.4	24.8
Major Emphasis	15.0	23.6	28.5	33.0
Math Problem-Solving Emphasis				
None	36.1	28.4	22.6	12.9
Minor Emphasis	30.4	26.4	23.9	19.4
Moderate Emphasis	21.5	25.9	25.7	26.9
Major Emphasis	17.1	24.0	27.8	31.1
Instructional Technique: Review Math From Previous Day				
Never	33.3	25.1	24.2	17.5
Sometimes	27.4	26.2	23.5	22.9
Often	16.1	24.5	28.2	31.2

* 3.1 percent are not taking sophomore math in any form

NOTE: Because of rounding, percentages may not sum to 100 percent.

SOURCE: National Education Longitudinal Study of 1988: First Follow-Up Student Survey, U.S. Department of Education, National Center for Education Statistics.

A number of comparisons of interest may be drawn from this table. Some of the most important comparisons are summarized below:

Race/Ethnicity

- Asians, followed by whites, show consistently higher mathematics achievement than do Hispanics or blacks.

  Thus, for example, 39 percent of Asians and 32 percent of whites score in the highest test quartile, as compared to 13 percent of Hispanics and 8 percent of blacks. Likewise, 42 percent of blacs and 35 percent of Hispanic sophomores scored in the lowest mathematics test quartile, compared to 14 percent of Asians and 17 percent of whites. .

School Control

- Independent schools show strikingly better mathematics test results than any of the other three school types, with over twice as many sophomores in the top math quartile than Catholic, public, or other private schools.

  More specifically, some 71.2 percent of independent school sophomores scored in the highest mathematics test quartile, as compared to 35 percent of Catholic school sophomores, 31 percent of tenth graders from other private schools, and 26 percent of sophomores in public schools.

SES

- Socioeconomic status was a strong predictor of mathematics test results. Over four times more low SES students than high are in the bottom quartile while four times more high SES students than low are in the highest test quartile. Thus 40 percent of low SES quartile sophomores scored in the lowest mathematics quartile, compared to 9 percent of the high SES sophomores. While 48 percent of the high SES sophomores scored in the highest mathematics quartile, only 8 percent of the low SES sophomores achieved such a score.

Sex

- As in the NELS:88 base year gender differences in mathematics achievement were comparatively small. Except for the male advantage in the highest math quartile, differences by quartile were not statistically significant.[22]

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[22]Differences between groups obtained from comparison of quartiles cannot automatically be assumed to form significant contrasts within different test result reporting formats, such as comparisons of overall mean scores or proficiency scores. (Nor are all differences that are statistically significant necessarily practically significant; consequently, effect sizes may also need to be taken into account.) Findings on mathematics achivement in relation to gender groups should therefore take account of some of the other analyses that have been conducted of NELS:88 data. In particular, it is useful to note that Rock and Pollack report mean scores for the first follow-up tests, in relation to numerous classification variables in [forthcoming, NCES 1992] Tenth Grade Cognitive Performance and Gains in Cognitive Performance Since Eighth Grade;

Math coursework

- Achievement in mathematics is associated with enrollment in more advanced courses. Over half (55 percent) of those who have taken only low-level math courses score in the lowest test quartile; just less than three percent of this group score in the highest math test quartile. On the other hand, over half (56 percent) of the advanced math group scored in the highest math quartile, with only 8 percent of the advanced math group scoring in the lowest test quartile for mathematics.

Perceived Instructional Emphasis

- Although instructional emphasis on facts and rules and instructional emphasis on problem-solving are sometimes viewed as alternative rather than complementary strategies, mathematics test results show a similar pattern for both emphases. That basic pattern is that for either factual or problem-solving emphases, students were more likely to score in the highest quartile if they perceived the objective as a major emphasis of the teacher. Tabular analyses cannot by themselves provide an explanation of such a pattern; perhaps this pattern of relationship reflects the simple fact that students who are sensitively attuned to what the teacher is stressing--regardless of what the teacher's emphasis might be--are more likely to be good learners than those who are less aware of what is being emphasized in the classroom. Or, possibly, high-achieving students are more likely to recognize the importance both of learning facts and procedures, and learning problem-solving strategies. In any event, high school sophomores who felt that their teacher placed strong emphasis on math facts and rules were significantly more likely to score in the top math quartile than students who felt facts and rules were not emphasized or received only minor emphasis. Likewise, students who felt that their teacher placed strong emphasis on mathematical problem-solving were significantly more likely to score in the top math quartile than students who felt problem-solving was not emphasized or received only minor emphasis.

  More specifically, in terms of a math facts and rules emphasis, 33 percent of sophomores who thought their teachers accorded this objective major emphasis scored in the highest math quartile, as contrasted to only 8.4 percent of those who felt this objective was not emphasized at all, and 17.4 percent of those who felt this objective was only a minor emphasis of their math teacher.

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there were no significant gender differences in overall mathematics scores, although a slightly higher proportion of tenth grade males than females had mastered complex problem-solving skills. Rock and Pollack also report that for eighth graders two years later, there were no significant differences between males and females with respect to overall gain scores from 1988 to 1990 in mathematics, nor were there differences in the proficiency levels at which gains were found. The close similarity of male and female results for NELS:88 sophomores is consistent with the results for NELS:88 eighth graders two years before, which showed no difference in math performance between boys and girls (Rock, Pollack, and Hafner, 1991--The Tested Achievement of the NELS:88 Eighth Grade Class, NCES 91-460). Given that there is more opportunity for differential course taking in eleventh and twelfth grades, it will be very much of interest to see whether boys continue, as in the past, to take more advanced math, and whether male-female differences in math achievement have asserted themselves by senior year--as HS&B and NAEP data suggest has historically been the case.

In terms of an emphasis on problem-solving, 31 percent of sophomores who thought their teachers accorded this objective major emphasis scored in the highest math quartile, as contrasted to 13 percent of those who felt this objective was not emphas' 'ed at all, and 19 percent of those who felt this objective was only a minor emphasis of their math her.

Learning Practices: review

- Sophomores who often reviewed their work from the previous day were least likely to fall into the lowest quartile and most likely to fall into the highest quartile in mathematics achievement. Students who never reviewed their work were most likely to fall into the lowest quartile and least likely to score in the highest quartile in mathematics achievement.

  More specifically, 31 percent of the sophomores who often reviewed their math work from the previous day scored in the highest math achievement quartile, with just 16 percent falling into the lowest. In cor..st 18 percent of sophomores who never review their work from the previous day scored in the highest quartile, while fully a third (33.3 percent) scored in the lowest quartile.

Conclusions. In this paper, we have made use of the longitudinal analysis population to produce illustrative findings about the transition to high school. These results have illustrated the rate of dropping out and persistence in school between 1988 and 1990 for 1988 eighth graders, as well as their mobility across school sectors and their perception of the academic and social environment of high school compared to their eighth grade experience. We have employed the cross-sectional nationally representative sample of spring term 1990 sophomores to examine the issue of learning and achievement, taking mathematics as an example. These results show both the relationship between a number of sociodemographic variables and achievement, and the relationship between cognitive outcomes and selected instructional practices and emphases. In addition, student reports indicate that tenth grade classroom practices diverge widely from the recommendations of the instructional standards developed by the National Council of Teachers of Mathematics in 1989.

In the appendices that follow, we describe the NELS:88 student data files (Appendix A); list available NELS:88 publications and documenation (Appendix B); provide technical notes for the analyses reported in this paper (Appendix C); and provide tables of standard errors and unweighted Ns for the tabular data reported in this paper.

Appendices

Appendix A: Description of the NELS:88 Student Data Files

Appendix B: NCES NELS:88 Publications and Documentation

Appendix C: Technical Appendix

Appendix D: Standard Errors of Measurement

Appendix A: The Combined BY-F1 Student Component Data Files

BY Student Data File. The base year file contains questionnaire data for all base year participants (N=24,599) regardless of whether or not they were retained in the first follow-up. This file is identical to the file that was released in 1989 after the completion of the base year survey. Included data elements are positioned on the file in the following sequence: student questionnaire data, weight, sample identification flags (e.g., presence or absence of a cognitive test battery), and composites (e.g., sex, race, parent education).

First Follow-Up Student Data File. The first follow-up student file contains a record for all 20,706 participating and nonparticipating first follow-up sample members. These 20,706 sample members consist of 19,646 base year retained sample members and 1,060 freshened sample members. Of the 20,706 first follow-up sample members, 19,264 participated--18,221 as students and 1,043 as dropouts (1,442 sample members did not participate).

The raw data file contains data for 546 questionnaire variables on the 18,221 participating students; 21 questionnaire variables on the 1,043 participating dropouts; and 12 sample identification flag variables, 66 composite variables (including cognitive test composite variables), and 66 new student supplement variables on all 20,706 participating and nonparticipating sample members. Of the 546 student questionnaire variables, 21 are variables that also appeared as questions in both the full and abbreviated dropout questionnaires. For these 21 variables, dropout data are included in with student data. Similarly, 53 or the 66 new student supplement variables also appeared as questions in the base year student questionnaire, thus, for these 53 variables, base year data are mapped into the new student supplement variables.

Included on the data file for the first follow-up student component are 21 dropout questionnaire variables, as well as first follow-up weights, sample identification flags and composites or dropouts. The 21 dropout questionnaire items represent crucial variables for defining and classifying the in-school and out-of-school samples. These dropout questionnaire variables and composites together with student questionnaire variables and composites will provide the user with a complete picture of the full first follow-up sample and longitudinal cohort.

For users wishing to address more specific questions about dropout phenomena, a separate dropout component data file has been produced. This file contains all dropout questionnaire variables, along with first follow-up weights, sample identification flags and composites for the 1,043 first follow-up dropouts. A separate data file users manual is also available.

B. Documentation

Information about the purposes of NELS:88, data collection instruments, sample design, and data collection and data processing procedures used both in the base year and first follow-up, is presented in the NELS:88 First Follow-Up: Student Component Data File User's Manual. The manual accompanies the magnetic tape version of the combined BY-F1 student component release. Three other first follow-up data file user's manuals have been produced to accompany each of the other first follow-up component data files--the dropout, school administrator, and teacher files.

The NELS:88 First Follow-up Student Component Data File User's Manual covers both the 1988 and 1990 waves of the study. As such, the manual supersedes the student component user's manual produced for the base year data tape; however, the base year codebook appearing in the first follow-up data user's manual contains frequencies only for the longitudinal panel (those base year respondents who also participated in the first follow-up [N=17,424]). Researchers interested in using the base year data cross-sectionally (N=24,599) may wish to refer to the codebook provided in the NELS:88 Base Year Student Component Data File User's Manual, which contains weighted estimates and unweighted frequencies for the full base year sample.

C. Magnetic Tape and CD-ROM Versions of the BY-F1 Combined Data Files

While initial release of NELS:88 first follow-up data is in the form of magnetic tape, the data files are now being prepared for release in CD-ROM as well. The CD-ROM version of the data will include an electronic codebook with search and retrieval software for use with SAS-PC or SPSS-PC+.

The presently available magnetic tape version of the combined BY-F1 student data does not include data on either the School Effects Augmentation or Base Year Ineligible Study. While both sets of data will be released on the combined BY-F1-F2 data file after the completion of the second follow-up, the 343 base year ineligible sample members who were found eligible to participate in the first follow-up will also be included on a future CD-ROM version of the combined BY-F1 data.

D. A Note on Confidentiality

Because multilevel microdata carries with it some risk of the possibility of statistical disclosure of institutions or individual identities, the NELS:88 data have been extensively analyzed to determine which items of information, used alone or in conjunction with other key variables, have significant disclosure potential. Variables that were found to pose significant disclosure risks have been suppressed or altered to remove or substantially reduce these risks. For example, in some cases, continuous variables have been recast as categorical variables, or fine-grained categorical variables have been more grossly categorized.

While the extremely high value that is placed on confidentiality--not only by federal statute, but also by NCES and contractor standards--justifies these alterations of the data, it is recognized that some of these protections against disclosure may at times reduce the analytic potential of certain variables in the data set. For this reason, NCES also makes **restricted use data files** available to qualified researchers with a proven need for the data in its restricted use form. To obtained the restricted use data, it is necessary for an organization to obtain a licensure agreement from NCES. The agreement must be signed by the principal investigator and by someone authorized to commit the organization to the legal requirements. In addition, each professional or technical staff member with access to the data must sign and have notarized an affidavit of nondisclosure. Institutionally-based researchers may apply to the Associate Commissioner of Education Statistics at the Statistical Standards and Methodology Division, National Center for Education Statistics (NCES), 555 New Jersey Avenue NW, Washington, D.C. 20208-5651, if they wish to pursue the possibility of obtaining access to the NELS:88 restricted use data files.

Appendix B: NELS:88 Published and Future Reports and Special Tabulations

Since the completion of the base year survey in 1988 and release of restricted use data late in 1989 and public use data in March of 1990, several reports and special tabulations have been published; many more are planned. This section of the paper provides a comprehensive list of NCES's Longitudinal and Household Studies Branch (LHSB) NELS:88 reports and special tabulations published thus far, as well as future publications and their estimated release dates. For information on how to order NELS:88 publications and data files, call the Education Information Branch of OERI at 1-800-424-1616 (219-1513 for callers within the District of Columbia).

RELEASED ANALYSIS REPORTS.

Hafner, A.; Ingels, S.J.; Schneider, B.; and Stevenson, D.L. **A Profile of the American Eighth Grader**, June 1990; NCES 90-458.

Hoachlander, E.G. **A Profile of Schools Attended by Eighth Graders in 1988**, September 1991; NCES 91-129.

Bradby, D. **Language Characteristics and Academic Achievement: A Look at Asian and Hispanic Eighth Graders in NELS:88**, February 1992; NCES 92-479.

RELEASED E.D. TABULATIONS.

Rasinski, K.A.; and West, J. **NELS:88: Eighth Graders' Reports of Courses Taken During the 1988 Academic Year by Selected Student Characteristics**, July 1990; NCES 90-459.

Rock, D.A.; Pollack, J.M.; and Hafner, A. **The Tested Achievement of the National Education Longitudinal Study of 1988 Eighth Grade Class**, April 1991; NCES 91-460.

RELEASED USER'S MANUALS/TECHNICAL REPORTS.

Ingels, S.J.; Abraham, S.; Rasinski, K.A.; Karr, R.; Spencer, B.D.; Frankel, M.R.; Owings, J.A. **NELS:88 Base Year Data File User's Manuals:**

STUDENT COMPONENT: March 1990; NCES 90-464*

PARENT COMPONENT: March 1990; NCES 90-466

SCHOOL COMPONENT: March 1990; NCES 90-482

TEACHER COMPONENT: March 1990; NCES 90-484

Spencer, B.D.; Frankel, M.R.; Ingels, S.J.; Rasinski, K.A.; and Tourangeau, R. **NELS:88 Base Year Sample Design Report**, August 1990; NCES 90-463.

Ingels, S.J.; Rasinski, K.A.; Frankel, M.R.; Spencer, B.D.; and Buckley, P.B. **NELS:88 Base Year Final Technical Report**, October 1990; Chicago: NORC.

* contains a codebook with frequency distributions for the full (24,599) 1988 participating cross-sectional sample.

Rock, D.A.; and Pollack, J.M. **Psychometric Report for the NELS:88 Base Year Test Battery,** April 1991; NCES 91-468.

Kaufman, P.; Rasinski, K.A.; Lee, R.; and West, J. **Quality of Responses of Eighth-Grade Students to the NELS:88 Base Year Questionnaire,** September 1991; NCES 91-487.

Ingels, S.J.; Scott, L.A.; Lindmark, J.T., Frankel, M.R.; Myers, S.L.; and Wu, S. **NELS:88 First Follow-Up Student Component Data File User's Manual.** March 1992; NCES 92-030.

Ingels, S.J.; Scott, L.A.; Lindmark, J.T., Frankel, M.R.; Myers, S.L.; and Wu, S. **NELS:88 First Follow-Up School Component Data File User's Manual.** April 1992; NCES 92-084.

FORTHCOMING LHSB NELS:88 REPORTS/E.D. TABULATIONS/USER'S MANUALS.

Ingels, S.J.; Scott, L.A.; Lindmark, J.T., Frankel, M.R.; Myers, S.L.; and Wu, S. **NELS:88 First Follow-Up Data File User's Manuals:**

DROPOUT COMPONENT: May 1992; NCES 92-083

TEACHER COMPONENT: May 1992; NCES 92-085

Rock, D.A., and Pollack, J.M. ED-Tab: **Tenth Grade Cognitive Performance and Gains in Cognitive Performance Since Eighth Grade.** (Estimated Release June 1992).

A Profile of American Eighth Grade Math and Science Instruction: NELS:88 Teachers, Schools, and Students (Estimated Release May 1992).

NELS:88 Base Year Parent Descriptive Report (Estimated Release May 1992).

Portrait of the At-Risk Eighth Grader (Estimated Release May 1992).

NELS:88 Transition Patterns Experienced by Students as They Move from Eighth Grade to Tenth Grade (Estimated Release December 1992).

NELS:88 First Follow-Up Student Profile: descriptive summary of the American tenth-grader. (Estimated Release June 1992; NCES 92-086).

NELS:88 First Follow-Up Final Technical Report (June 1992).

Comparison of NELS:88 1990 Sophomores and HS&B 1980 Sophomores. (Estimated Release July 1992; NCES 92-087).

NELS:88 First Follow-Up Dropout Descriptive Report (Estimated Release September 1992).

Appendix C

Methodological and Technical Notes

Additional information about the aims and design of the study, data collection results, and documentation of the data files is provided in the various user's manuals and technical reports detailed in the preceding section. Detailed information on the sample design, universe coverage, sample selection procedures, weighting methodology, selected standard error estimates, estimates of design effects for broad categories of students, and results of nonresponse analyses, is reported in the base year sample design report, first follow-up student data file user's manual, and the base year and first follow-up final technical reports (see Appendix B for complete references).

Accuracy of Estimates.

The accuracy of reported statistics is determined by the joint effects of sampling and nonsampling errors. Sample surveys such as NELS:88, and universe surveys as well, are subject to nonsampling errors. Nonsampling error may arise from a number of sources, such as the inability to obtain cooperation from a sample member, or the unwillingness or inability of a respondent to answer a given item asked in a survey. In addition, exclusion of persons who should be included in the universe, variability in providing estimates, differences in interpreting the meaning or intent of questions, errors in data capture, editing or coding may also result in nonsampling error. Nonsampling errors in NELS:88 are discussed in the base year and first follow-up user's manuals and technical reports. The overall quality of the base year student questionnaire data is assessed in Kaufman, Rasinski, Lee and West (see the preceding appendix for a complete citation.)

For reliability and validity information concerning the base year cognitive tests, see the base year psychometric report (Rock and Pollack, 1991; the preceding appendix contains the complete citation). Score means and standard deviations, reliabilities (coefficient alpha), and standard errors of measurement for each NELS:88 first follow-up subtest are as follows:

	MEAN	S.D.	ALPHA	S.E.
Reading--Low Form . . .	11.6	4.4	.80	2.0
Reading--High Form . . .	14.1	4.1	.78	1.9
Mathematics--Low Form	17.4	6.1	.79	2.8
Mathematics--Mid Form	23.3	7.5	.86	2.8
Mathematics--High Form	32.3	5.0	.81	2.2
Science	13.7	5.2	.83	2.2
Social Studies	18.9	6.0	.85	2.3

Further documentation of the psychometric properties of the cognitive test battery can be found in the first follow-up final technical report.

Estimates of sampling variability--expressed as the standard error of measurement--appear in Appendix D. Sampling errors occur because the data are collected from a sample of the population rather than the entire population. The standard error is a measure of the variability due to sampling when measuring a parameter. It indicates how much variance there is in the population of possible estimates of a parameter for a given sample size. Standard errors can be used as a measure of the precision expected from a particular sample.

The sample estimate and an estimate of its standard error permit us to construct interval estimates with prescribed confidence that the interval includes the average result of all possible samples. An interval from two standard deviations below an estimate to two standard deviations above an estimate constitutes a 95 percent confidence interval.

NELS:88 estimates the tenth grade public school population at a total that falls somewhat below the number recorded by the NCES Common Core of Data. This discrepancy is partly a function of the exclusion of certain schools from the NELS:88 base year sampling frame, the exclusion of 5.34 percent of the students in the schools that were included in the sampling frame, and the difference between autumn and spring enrollment figures (fall enrollments tend to be higher--spring enrollment figures reflect attrition within the grade, particularly the impact on enrollment of dropping out). (Many of the excluded base year students--specifically, those whose eligibility status has changed, or who were deemed to have been misclassified--will be added in to the NELS:88 longitudinal sample, to reflect the results of the Base Year Ineligibles study of the first follow-up, and the Followback Study of Excluded Students of the second follow-up.)

Statistical Procedures

Comparisons that have been drawn in the text of this paper have been tested for statistical significance to ensure that the differences are larger than those that might be expected due to sampling variation. The statistical comparisons in this report were based on the **t** statistic. Generally, whether the statistical test is considered significant or not is determined by calculating a **t** value for the difference between a pair of means or proportions and comparing this value to published tables of values at certain critical levels, called alpha levels. The alpha level is an a **priori** statement of the probability that a difference exists in fact rather than by chance.

To guard against errors of inference based upon multiple comparisons, the Bonferroni procedure[23] to adjust significance tests for multiple contrasts was used. This method corrects the significance (or alpha) level for the total number of contrasts made with a particular classification variable. For each classification variable, there are (K*(K-1)/2 possible contrasts (or nonredundant pairwise comparisons), where K is the number of categories. For example, if a classification variable has four categories, K=4 and there are (4*3)/2=6 possible comparisons between the categories. The Bonferroni procedure divides the alpha-level for a single t-test (for example, .05) by the number of possible pairwise comparisons to derive a new alpha corrected for the fact that multiple contrasts are being made.

Interested readers can compute the **t** statistic between estimates from various subgroups presented in the tables using the following formula:

$$t = \frac{P1 - P2}{\sqrt{(se1 * se1 + se2 * se2)}}$$

where **P1** and **P2** are the estimates to be compared and **se1** and **se2** are their corresponding standard errors.

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[23] For detailed discussion, see, for example, Hays, W.L. 1988. Statistics. (4th ed.) New York: Holt, Rinehart, Winston; Myers, J.L. 1979. Fundamentals of Experimental Design. (3rd ed.) Boston: Allyn and Bacon; and Klockars, A.J. and Sax. G. 1986. Multiple Comparisons. Beverly Hills: Sage.

Analysis Procedures

The combined base year-first follow-up student data files contain several distinct analysis populations. These include:

Population 1: The eighth grade cohort in 1988;

Population 2: A subsample of the 1988 eighth grade cohort in 1990;
Population 3: The sophomore cohort in 1990, comprising all members of population 2 who are enrolled in tenth grade, and a sample of freshened students.

The basic first follow-up nonresponse-adjusted weight--F1QWT--sums to all sophomores (including students added in sample freshening), and all retained members of the eighth grade cohort regardless of grade or enrollment status. In other words, the data file population is the sum of groups 2. and 3. above, minus the overlap between these populations. While these populations overlap to a high degree, they are also distinct. Cross-sectional analyses reported in this paper therefore were restricted to students enrolled in tenth grade in the spring term of the 1990 school year--students out of grade sequence and dropouts (including dropouts from the freshening sample) were excluded. Longitudinal analyses, on the other hand, employed the special panel flag and panel weight, for the 17,424 members of the eighth grade cohort who completed a questionnaire both in 1988 and 1990. For details on proper use of weights and flags to define analysis populations in NELS:88, see the *First Follow-up Student Component User's Manual*.

This document reports univariate distributions and crosstabular analyses. Nevertheless, many of the background variables commonly employed in educational research (race, socioeconomic status, parent education, and so on) are highly related to each other. Readers are cautioned that multivariate analysis, which was not utilized in this report, generally allows for a more appropriate description of such interrelationships.

Variables Used

A number of classification variables have been constructed for analytic purposes. Some of these constructed variables appear on the student data files for the convenience of data users; others were specially constructed for this paper.

An example of a variable specially created for this paper is the mathematics opportunity to learn or math advanced course-taking variable. This variable was derived in the following way.

Math Coursework Level. Using question F1S22 from the student questionnaire, all individuals were selected who reported having taken at least one year of coursework from the following categories (the year could be a cumulative total across the listed courses):

algebra 2, trigonometry, pre-calculus, calculus

This was defined as the "advanced" math group. The "middle" level group comprised those individuals who did not qualify for the "advanced" group but report taking one year or more of algebra 1 or geometry. Finally, the low level math group consisted of all remaining students.

Another variable created for analysis purposes was **1990 Family Composition**. This variable represents a collapsed presentation of student questionnaire item 92 (F1S92).

Classification variables taken directly from the student data files include socioeconomic (SES) status quartile, race/ethnicity, school control, urbanicity (metropolitan status), and mathematics test quartile. Further detail about the derivation of these variables is presented in the *First Follow-up Student Component Data File User's Manual*.

Socioeconomic Status. **F1SES** was constructed using base year parent questionnaire data, when available. The following parent data were used: father's education level, mother's education level, father's occupation, mother's occupation, and family income (data coming from BYP30, BYP31, FYP34B, BYP37B and BYP80). Education-level data were recoded according to the definition of BYPARED described below. Occupational data were recoded using the Duncan SEI scale as used in HS&B and NLS-72. Parent data were used to construct F1SES if at least one component was not missing.

Each nonmissing component (after any necessary recoding) was standardized to a mean of 0 and a standard deviation of 1. Nonmissing standardized components were averaged yielding the F1SES composite.

F1SESQ is the quartile into which F1SES falls. It was constructed by recoding F1SES into quartiles based on the weighted, F1QWT, marginal distribution. The values for F1SESQ are:

1 = Quartile 1 **Low**; 2 = Quartile 2; 3 = Quartile 3; 4 = Quartile 4 **High**

Race/Ethnicity. Race is a composite variable, that is, it was constructed from several sources of information. The first source was the student self-report (from the base year questionnaire or first follow-up new student supplement). If the student information was missing, data from the parent questionnaire were used, or from sampling rosters if parent data were unavailable as well. The race categories are Asian/Pacific Islander; Hispanic, regardless of race; Black, not of Hispanic origin; and American Indian or Alaskan Native.

School Control. Two different school classification schemes are used in the NELS:88 data. The scheme used in this paper classified schools by their control into public, Catholic, independent (defined as members of the National Association of Independent Schools) and all other private schools.

Urbanicity. This is the metropolitan status of the sample member's school. This variable classifies the urbanicity of the student's school in accordance with the Federal Information Processing Standards (FIPS) as used by the U.S. Census. The variable **G10URBAN** used in this paper gives information about the student's school in the 1989-90 school year when most sample members were in tenth grade.

The values for G10URBAN are:

1 = Urban -- central city
2 = Suburban -- area surrounding a central city within a county constituting the MSA (Metropolitan Statistical Area)
3 = Rural -- outside MSA
5 = Not enrolled in school

Appendix D
Standard Errors of Measurement; Unweighted Ns

Standard Errors for Table 4: NELS:88 eighth-grade expanded and base year-eligible cohort dropout and retention rates, by sex and race/ethnicity spring term 1990. (Standard errors appear parenthetically, followed by unweighted N.)

Selected Characteristics	1988 Expanded Eighth Grade Cohort enrollment status (unwted N =19,477); percent not enrolled:	1988-Eligible Eighth Graders' enrollment status (unwted N =17,381); percent not enrolled:
TOTAL	6.8	6.1
	(0.40)	(0.48)
SEX		
Male	7.2	6.3
	(0.55)	(0.69)
	9,796	8,620
Female	6.5	5.8
	(0.51)	(0.59)
	9,681	8,761
RACE-ETHNICITY*		
Asian/Pacific Islander	4.0	3.1
	(1.02)	(1.05)
	1,258	1,054
Hispanic	9.6	9.2
	(0.84)	(1.01)
	2,593	2,141
Black, non-Hispanic	10.2	10.0
	(1.51)	(1.94)
	1,989	1,755
White, non-Hispanic	5.2	4.9
	(0.44)	(0.53)
	12,966	12,222

*Not shown separately: "race unknown" (unweighted N = 434 in expanded sample) and, owing to the small sample size, American Indian (unweighted N = 237).

NOTE: Because of rounding, percentages may not sum to 100 percent.

SOURCE: National Education Longitudinal Study of 1988: First Follow-Up Student Survey, U.S. Department of Education, National Center for Education Statistics.

Table 5
SEs for Percentage of eighth grade longitudinal cohort who changed school sectors from middle or junior high school to high school

	Tenth Grade Sector			
	Public	Catholic	Independent	Other Priv.
Eighth Grade Sector				
s.e.	0.29	0.22	0.11	0.16
unweighted N	13656	13656	13656	13656
s.e	3.41	2.96	1.99	0.16
unweighted N	1319	1319	1319	1319
s.e.	2.79	1.78	3.87	2.61
unweighted N	1104	1104	1104	1104
s.e.	6.38	2.76	0.00	6.62
unweighted N	532	532	532	532

Standard Errors for Table 10:
Proficiency Results by Sociodemographic Variables and School Control

PERCENTAGE OF 1990 SOPHOMORES AT EACH PROFICIENCY LEVEL	BELOW LEV 1		LEVEL 1		LEVEL 2		LEVEL 3		LEVEL 4	
	%	SE	%	SE	%	SE	%	SE	%	SE
TOTAL SAMPLE	11.23	(0.63)	26.53	(0.88)	14.77	(0.70)	25.09	(0.86)	22.38	(0.83)
SEX										
MALE	12.04	(0.91)	24.55	(1.21)	14.95	(1.00)	23.82	(1.20)	24.64	(1.21)
FEMALE	10.41	(0.86)	28.51	(1.27)	14.60	(0.99)	26.36	(1.24)	20.11	(1.13)
RACE/ETHNICITY										
ASIAN	6.63	(1.89)	18.68	(2.97)	8.92	(2.17)	34.75	(3.62)	31.02	(3.52)
HISPANIC	15.74	(2.11)	39.78	(2.83)	15.73	(2.11)	16.63	(2.16)	12.12	(1.89)
BLACK, NON-HISP.	20.18	(2.55)	42.79	(3.14)	16.60	(2.36)	14.59	(2.24)	5.84	(1.49)
WHITE, NON-HISP.	9.14	(0.68)	22.08	(0.98)	14.68	(0.84)	27.65	(1.06)	26.45	(1.05)
SES										
LOW QUARTILE	18.08	(1.70)	43.33	(2.18)	16.44	(1.63)	15.10	(1.58)	7.05	(1.13)
SECOND QUARTILE	13.27	(1.41)	30.43	(1.91)	17.01	(1.56)	24.20	(1.78)	15.09	(1.49)
THIRD QUARTILE	9.85	(1.21)	23.11	(1.71)	16.53	(1.51)	28.67	(1.84)	21.84	(1.68)
HIGH QUARTILE	4.41	(0.74)	12.76	(1.21)	10.20	(1.09)	30.72	(1.67)	41.91	(1.78)
SCHOOL CONTROL										
PUBLIC	11.91	(0.70)	27.62	(0.96)	14.81	(0.76)	24.60	(0.92)	21.05	(0.87)
CATHOLIC	3.71	(1.57)	19.96	(3.32)	15.70	(3.02)	29.31	(3.78)	31.32	(3.85)
INDEPENDENT	5.76	(1.85)	1.11	(0.83)	10.33	(2.42)	18.18	(3.06)	64.62	(3.80)
OTHER PRIVATE	4.96	(2.93)	17.68	(5.14)	12.10	(4.40)	37.66	(6.53)	27.61	(6.03)

Unweighted Ns:

Unweighted sophomore N for math test results = 16,682

Sophomores assigned mathematics proficiency scores = 14,603

Sex: Male =7,309; Female = 7,294

Race/Ethnicity: Asian = 994; Hispanic = 1,717; Black = 1,429; White = 10,244; American Indian = 161

SES: lowest quartile = 2,967; second = 3,335; third = 3,495; high = 4,403

Sector of School Control: Public = 12,514; Catholic = 835; NAIS = 913; Other Private = 317

Standard Errors for Table 11
Math Test Quartile by background characteristics, opportunity to learn, and instructional factors.

Note: Standard errors of measurement appear parenthetically after each percentage estimate. All sampling variance statistics are Taylor Series approximations. Sample Ns appear below the standard errors.

MATHEMATICS TEST QUARTILE:	Lowest Qtle	22 - 49%	50 - 74%	Highest Qtle
Race/Ethnicity				
Asian/PI	**13.8**	**20.4**	**26.9**	**39.0**
s.e.	(2.11)	(2.15)	(2.27)	(2.57)
unwted N=1092				
Hispanic	**34.6**	**32.5**	**20.2**	**12.7**
s.e.	(1.78)	(1.63)	(1.32)	(1.01)
unwted N=1968				
Black	**41.8**	**31.6**	**18.2**	**8.4**
s.e.	(2.53)	(2.24)	(1.69)	(1.06)
unwted N=1620				
White	**16.8**	**23.5**	**28.1**	**31.6**
s.e.	(0.60)	(0.61)	(0.58)	(0.77)
unwted N=11741				
AI/NA	**51.8**	**24.6**	**16.7**	**6.9**
s.e.	(5.82)	(3.64)	(3.76)	(2.84)
unwted N=189				
School Control				
Public	**23.3**	**25.8**	**25.3**	**25.7**
s.e.	(0.67)	(0.60)	(0.54)	(0.66)
unwted N=14345				
Catholic	**10.2**	**21.0**	**34.0**	**34.8**
s.e.	(2.03)	(2.24)	(2.80)	(2.89)
unwted N=952				
Independent	**5.3**	**10.0**	**13.5**	**71.2**
s.e.	(4.11)	(4.46)	(2.94)	(6.55)
unwted N=988				
Other Private	**9.8**	**22.4**	**36.8**	**31.0**
s.e.	(3.05)	(3.37)	(2.82)	(3.61)
unwted N=370				

Standard Errors for Table 11
Math Test Quartile by background characteristics, opportunity to learn, and instructional factors. (continued)

	Lowest Qtle	22 - 49%	50 - 74%	Highest Qtle
Socioeconomic Status				
Low	**40.1**	**31.3**	**19.8**	**8.8**
s.e.	(1.26)	(1.25)	(0.97)	(0.62)
unwted N=3395				
Middle	**20.8**	**28.2**	**27.5**	**23.5**
s.e.	(0.78)	(0.85)	(0.74)	(0.71)
unwted N=7879				
High	**8.1**	**15.1**	**28.7**	**48.1**
s.e.	(0.93)	(0.77)	(0.99)	(1.22)
unwted N=4933				
MATHEMATICS TEST QUARTILE:				
Sex				
Male	**22.2**	**24.5**	**24.8**	**28.6**
s.e.	(0.85)	(0.79)	(0.72)	(0.86)
unwted N=8304				
Female	**21.9**	**25.9**	**27.1**	**25.2**
s.e.	(0.80)	(0.78)	(0.76)	(0.81)
unwted N=8378				
Math Coursework Level				
Low	**55.0**	**32.7**	**9.5**	**2.8**
s.e.	(1.41)	(1.33)	(0.72)	(0.46)
unwted N=3682				
Middle	**12.9**	**27.7**	**34.9**	**24.5**
s.e.	(0.61)	(0.82)	(0.80)	(0.84)
unwted N=8543				
Advanced	**8.0**	**12.6**	**23.3**	**56.1**
s.e.	(0.69)	(0.87)	(1.07)	(1.42)
unwted N=4374				

Standard Errors for Table 11
Math Test Quartile by background characteristics, opportunity to learn, and instructional factors. (continued)

	Lowest Qtle	22 - 49%	50 - 74%	Highest Qtle
Instructional Demand: Asked to Show Understanding in Math				
Not Taking*	**42.2**	**36.6**	**14.1**	**7.2**
s.e.	(3.14)	(4.03)	(2.27)	(1.87)
unwted N=451				
Never Asked	**27.6**	**25.6**	**23.1**	**18.3**
s.e.	(1.77)	(1.73)	(1.81)	(1.40)
unwted N=1409				
Less Than Once a Week	**21.4**	**25.1**	**25.6**	**27.8**
s.e.	(1.23)	(1.23)	(1.30)	(1.35)
unwted N=2009				
About Once a Week	**18.6**	**24.3**	**26.2**	**30.9**
s.e.	(1.13)	(1.42)	(1.21)	(1.39)
unwted N=2608				
A Few Times a Week	**19.0**	**25.0**	**27.2**	**28.8**
s.e.	(1.14)	(1.12)	(1.07)	(1.18)
unwted N=3859				
Almost Every Day	**22.0**	**24.7**	**25.7**	**27.6**
s.e.	(1.01)	(0.98)	(0.92)	(1.04)
unwted N=6211				

* 3.1 percent are not taking sophomore math in any form

Standard Errors for Table 11
Math Test Quartile by background characteristics, opportunity to learn, and instructional factors. (continued)

MATHEMATICS TEST QUARTILE:	Lowest Qtle	22 - 49%	50 - 74%	Highest Qtle
Perceived Instructional and Curricular Emphasis: Math Facts/Rules Emphasis				
None	**43.3**	**30.2**	**18.1**	**8.4**
s.e.	(2.33)	(2.13)	(2.00)	(1.44)
unwted N=97				
Minor Emphasis	**31.6**	**28.5**	**22.6**	**17.4**
s.e.	(1.54)	(1.73)	(1.20)	(1.10)
unwted N=2081				
Moderate Emphasis	**24.1**	**25.8**	**25.4**	**24.8**
s.e.	(1.23)	(0.98)	(0.98)	(0.96)
unwted N=4870				
Major Emphasis	**15.0**	**23.6**	**28.5**	**33.0**
s.e.	(0.65)	(0.77)	(0.72)	(0.88)
unwted N=8603				
Math Problem-Solving Emphasis				
None	**36.1**	**28.4**	**22.6**	**12.9**
s.e.	(2.10)	(2.05)	(2.00)	(1.50)
unwted N=785				
Minor Emphasis	**30.4**	**26.4**	**23.9**	**19.4**
s.e.	(1.55)	(1.41)	(1.33)	(1.21)
unwted N=1860				
Moderate Emphasis	**21.5**	**25.9**	**25.7**	**26.9**
s.e.	(1.06)	(1.08)	(0.94)	(1.12)
unwted N=4933				
Major Emphasis	**17.1**	**24.0**	**27.8**	**31.1**
s.e.	(0.79)	(0.73)	(0.77)	(0.87)
unwted N=8613				

Standard Errors for Table 11
Math Test Quartile by background characteristics, opportunity to learn, and instructional factors. (continued)

MATHEMATICS TEST QUARTILE:	Lowest Qtle	22 - 49%	50 - 74%	Highest Qtle
Instructional Technique: Review Math From Previous Day				
Never	**33.3**	**25.1**	**24.2**	**17.5**
s.e.	(2.00)	(1.71)	(1.59)	(1.28)
unwted N=1251				
Sometimes	**27.4**	**26.2**	**23.5**	**22.9**
s.e.	(1.05)	(0.89)	(0.81)	(1.04)
unwted N=5405				
Often	**16.1**	**24.5**	**28.2**	**31.2**
s.e.	(0.73)	(0.79)	(0.70)	(0.86)
unwted N=9582				

NOTE: Because of rounding, percentages may not sum to 100 percent.

SOURCE: National Education Longitudinal Study of 1988: First Follow-Up Student Survey, U.S. Department of Education, National Center for Education Statistics.

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